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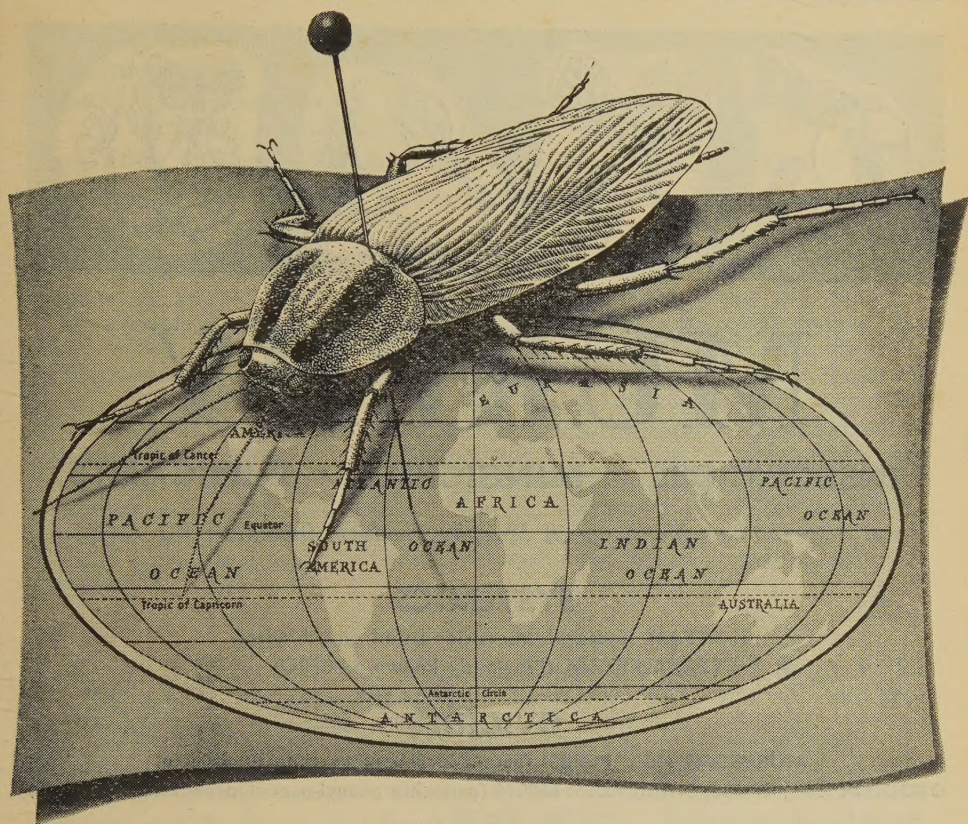
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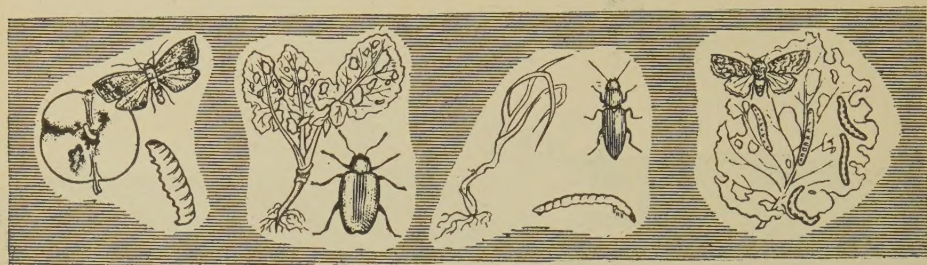
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- THOMAS (I.) & AITKENHEAD (P.). **Colorado Beetle in England, 1951.**—*Agriculture* 59 no. 3 pp. 129–133, 1 map. London, 1952.
- THOMAS (I.) & HARRISON (I. R.). **Colorado Beetle in England, 1952.**—*Op. cit.* 60 no. 3 pp. 138–142, 2 graphs, 1 map, 1 ref. 1953.
- THOMAS (I.). **Colorado Beetle in 1953.**—*Op. cit.* 61 no. 1 pp. 41–43. 1954.
- HARRISON (I. R.). **Colorado Beetle in 1954.**—*Op. cit.* 62 no. 2 pp. 94–95. 1955.

The Colorado beetle [*Leptinotarsa decemlineata* (Say)] was found in England in smaller numbers in 1951 than in previous years [*cf. R.A.E., A* 40 226, etc.], and there were further progressive decreases during the other three seasons under review, largely, it is thought, because infestation in continental Europe was relatively light. Breeding colonies were found on potato only in 1951, when there were eight, and 1952, when there were two, all in the south-east. The usual measures were applied. The numbers of isolated adults declined markedly in 1953 and again in 1954 when the importation of lettuce from infested parts of southern Europe was restricted a month earlier than previously. The circumstances in which they were taken are described in detail. Protective dusts and sprays of DDT were applied each year, but the areas treated were reduced progressively in 1951–53.

- SMALL (T.) & THOMAS (G. E.). **Colorado Beetle in Jersey. A Study of the Problem of Seaborne Invasions.**—*Agriculture* 61 no. 3 pp. 118–122, 1 map, 4 refs. London, 1954.

Adults of the Colorado beetle [*Leptinotarsa decemlineata* (Say)] were washed up in large numbers on the shores of Jersey in 1947 and on 11 occasions in 1948–53 [*cf. R.A.E., A* 38 231; 40 225]. The evidence indicated that they came from the Cotentin peninsula of France [*cf. A* 40 226], where *L. decemlineata* became prevalent during and soon after the war. The invasions took place during May–June, beginning on the north and east coasts of Jersey, and the beetles concerned were overwintered ones that emerged from fields under cereals and were forced to migrate owing to lack of food. Since at that time of year the prevailing temperatures favour flight (for which the optimum is about 68–77°F.) and the prevailing winds are easterly, the beetles are carried towards Jersey. They probably fall into the sea 2–2½ miles from the French coast and drift with the tidal currents running north and south. If the wind reaches 13 miles per hour and is easterly, they are quickly blown to the shores of Jersey, and many may still be alive on arrival. In a test in 1952, all of 400 kept in the laboratory died within 24 hours, but active beetles were observed on the beaches on other occasions.

The only practical method of reducing the risk of invasion is the chemical control of the beetles in the Cotentin prior to hibernation, and two spray applications are necessary in most years. An inherent difficulty lies in the fact that potato crops are normally of little importance there and farmers are reluctant to apply sprays, especially in July–August, when beetle numbers are highest and treatment can be applied to reduce the overwintering population. A dust of 5 per cent. DDT applied in August 1950 to a field in the Cotentin reduced the average number of adults from 7 to 1.5 per plant. A preliminary campaign with sprays applied from helicopters was carried out near Caen in 1949 but this method of application was costly and would be unsuitable for the small fields bounded by hedgerows characteristic of the Cotentin. A campaign in the northern part of the peninsula

was begun in 1950 and extended southwards in 1951, and the potato-growing areas were relatively free from infestation by late June 1952. There appeared to be no reinfestation of coastal areas from the interior. In a discussion of the future prospects, it is stated that although the campaign reduced populations in the peninsula, it is uncertain whether the reduction will be sufficient to eliminate the risk of sea-borne invasion, since unfavourable conditions for the beetle in 1946 did not prevent a heavy invasion in 1947. Invasion in 1953 was extremely light, but this was probably due to unfavourable weather.

JØRGENSEN (J.). **Biology of the Alfalfa Snout Beetle (*Otiorrhynchus ligustici* L.) in Denmark.**—*K. VetHøjsk. Aarsskr.* 1953 pp. 105–146, 21 figs., 50 refs. Copenhagen, 1953.

The lucerne weevil, *Otiorrhynchus ligustici* (L.), has become of increased importance in Denmark [*cf. R.A.E.*, A 40 190], and since little was known of its bionomics there, investigations were carried out in 1949–51 in the field and the laboratory. The results are given in detail and compared with those recorded from other countries [*cf. 2* 669; **25** 179; **30** 386]. The nomenclature and distribution of the weevil are briefly reviewed, all stages are described, and characters are given by which the adults can be distinguished from those of other weevils that occur in Denmark. No males were observed.

In 1950, the overwintered adults first emerged from the soil on 19th April, and many were present in the field on 28th April. The numbers of almost mature eggs in weevils dissected on 1st–7th June ranged from 0 to 74 and averaged 33.8. Females kept with lucerne leaves in petri dishes from late May to early October 1951 oviposited between 6th June and 2nd September, but indications were obtained that oviposition may begin somewhat earlier in the field. The number of eggs laid by one individual ranged from 27 to 521, peaks of oviposition occurring in July and early August, when maximum temperatures were highest. Four of seven examples in field cages hibernated after oviposition and oviposited again in the laboratory in the following year, laying a total of 569 eggs between 7th June and 11th July, of which 48 per cent. hatched. At laboratory temperatures of about 18–22°C. [64.4–71.6°F.], the eggs hatched in 12–24 days, with an average of 15.3 days. The percentage viability averaged 64.2 in 1950 and 33.2 in 1951.

The number of larval instars [*cf. 23* 465] could not be verified. Of a group of larvae examined in November 1950, at the beginning of hibernation, 70 per cent. were thought to be full-fed. The larger larvae were placed in containers in the soil and examined in October 1951, when 25 per cent. of the examples recovered were full-fed larvae and 75 per cent. were adults, indicating that larvae that are not full-fed in autumn resume feeding in the following year and hibernate for a second time before pupating, so requiring three years to complete the life-cycle [*cf. 30* 386]. Observations of the vertical movements of the larvae in the soil in autumn showed that whereas over 84 per cent. were in the upper 4 ins. on 26th October, 6.1, 17.1, 28, 17.1, 23.2 and 8.5 per cent. were at maximum depths of 4, 8, 12, 16, 20 and 24 ins. on 30th November. In further studies on the depths at which the larvae hibernate, the percentage survival was at least 80 for all depths down to 26 ins., except at 2 ins., at which it fell to 75, probably owing to temperature fluctuations. Pupae were present from 16th June to 3rd August or later, and the pupal stage averaged 20–30 days. The adults, which remain in the pupal cells until the following year, were observed from 14th July. Mass migrations of the adults in spring have not been observed

in Denmark, but in May 1950, large numbers were found to have entered a strawberry planting and to be causing serious damage.

In studies on the food-plants of the larvae, adults were caged on eight species of leguminous plants in the field in 1950 and 1951. Larvae developed in numbers only on *Lotus corniculatus* and lucerne; a few developed on alsike clover (*Trifolium hybridum*) in both years and on *Medicago lupulina*, red clover (*T. pratense*) and white clover (*T. repens*) in one year, but none appeared on *Anthyllis vulneraria* or sweet clover (*Melilotus alba*). When adults were given a choice of 12 species of cultivated plants at the time of oviposition, the largest numbers of larvae developed on white clover and broad bean (*Vicia faba*) and a few appeared on other leguminous plants and strawberry. Broad beans have not been previously recorded as a food-plant of the larvae. The plants were in the seedling stage, and the germinated seeds provided a large part of the nutriment. In tests with various weeds, larvae were found in the first instar on *Cirsium arvense*, in the second and fourth on *Rumex obtusifolius*, and in the first three on *Achillea millefolium*. The adults fed on the leaves of all eight plants in the first test of larval food-plants. When they were given a choice, the plants completely destroyed were white clover, broad bean, yellow lupin (*Lupinus luteus*), *T. hybridum* and *Lotus corniculatus*, strawberry was seriously injured, *M. alba*, *Medicago lupulina* and red clover were rather seriously damaged, injury to lucerne and *Anthyllis vulneraria* was insignificant, and peas were left almost untouched. In other tests, beet did not appear to be a suitable food-plant, but the weevils thrived on young swede, rape and yellow mustard (*Sinapis alba*) in mixed plantings. They were observed on all the wild plants attacked by the larvae and also on *Capsella bursa-pastoris* and *Chenopodium album*; wild carrot (*Daucus carota*) and broad-leaved plantain (*Plantago major*) were attacked only in the absence of the other plants.

NUORTEVA (P.) & VEIJOLA (T.). **Studies on the Effect of Injury by *Lygus rugulipennis* Popp. (Hem., Capsidae) on the Baking Quality of Wheat.**—*Ann. ent. fenn.* 20 no. 2 pp. 65–68, 1 fig., 20 refs. Helsinki, 1954.

Investigations in Finland in 1952 showed that the baking quality of flour milled from wheat containing 12–21 per cent. kernels injured by the Mirid, *Lygus rugulipennis* Popp., was not significantly affected by the attack.

KALOPISSIS (I. Th.) & others. **The Control Experiment against *Dacus* in Kirra-Itea (1953).** [*In Greek.*]—[9+] 90 pp., 18 figs., refs. Athens, 1954. (With Contents and Summary in English, [3+] 3 pp., multigraph.)

A detailed account is given of experiments on the control of *Dacus oleae* (Gmel.) on olives of an edible variety carried out on several thousand trees near the villages of Kirra and Itea, on the Gulf of Corinth, in 1953. Sprays of malathion gave little control at 0.1 per cent., three applications reducing the percentage infestation from 60.23 to 52.07, and proved harmful to the fruits at higher concentrations. Parathion was very effective [*cf.* also *R.A.E.*, A 43 173], the infestation percentages after three applications averaging 32.27, 25.47, 17.87 and 4.53 for wettable-powder sprays containing 0.03, 0.05, 0.1 and 0.2 per cent. parathion, respectively, and 27.8 and 21.37 for 2 and 3 per cent. dusts. The difference between the two strongest sprays was significant, and it was shown in a further experiment that the number of applications of the 0.2 per cent. spray could safely be reduced to two. As there was no attack before the beginning of oil formation, applications were

not made until after that time. The parathion deposits remained effective against the adults for at least 12 days, and the 0.1 and 0.2 per cent. sprays were effective against the larvae for at least a month after the last application. No effect on the eggs or pupae was observed. Residues in the olives in no case exceeded the limit of tolerance of 3 parts per million established by the U.S. Food and Drug Administration [cf. 43 174].

Studies of the catches of *Dacus* adults in traps showed that, when the population was constant, these were inversely proportional to the relative humidity and are therefore unreliable for estimating the correct time to apply treatments. More accurate results are obtained by counts of the adults that fall from the trees after special applications of parathion.

**NIRULA (K. K.), ANTONY (J.) & MENON (K. P. V.). Some Investigations on the Control of Termites.**—*Indian Cocon. J.* 7 no. 1 pp. 1-9, 33 refs. Ernakulam, 1953.

Termites are important pests of coconut seedlings on the west coast of India, the commonest being *Odontotermes (Termes) obesus* (Ramb.). They cause losses of about 20 per cent. in nurseries on lateritic soils, but are not injurious on sandy soil. Attack begins at the base of the seed nut. As a result, the central shoot wilts, and this may be followed by the death of the seedling. Transplanted seedlings are also severely damaged, but the attack does not usually become apparent until they are 2-4 years old. Damage to mature palms is not important. Measures for the control of termites attacking crops are reviewed. In preliminary tests of soil treatments, parathion was mixed with soil in jars at 0.01, 0.005 and 0.002 per cent. by weight and other toxicants at 0.1, 0.05 and 0.01 per cent. The soil was sprayed with water and covered with wet blotting paper, and ten worker termites from a coconut nursery were released in each jar. The termites entered the soil in all jars, and mortality was recorded at intervals up to 96 hours. Each lot of soil was used five times, after moistening. BHC, pentachlorophenol, parathion and sodium pentachlorophenate appeared to be the most effective. All gave complete mortality in three hours at the two highest concentrations at which they were used, and the last two also at the lowest, but toxicity was reduced in the later tests. Parathion seemed the most promising, but its use on a large scale may not be practicable owing to its toxicity to mammals and its low degree of persistence. Chlordane gave complete mortality in 24, 48 and 48 hours at the three dilutions, respectively, and did not deteriorate with time. Both toxaphene and DDT gave complete mortality in 24, 48 and 72 hours, respectively, at the three dilutions. DDD was the least effective material, but gave complete mortality in 48 and 72 hours at the two highest concentrations.

**HUECK (H. J.). The Population-dynamics of the Fruit Tree Red Spider (*Metatetranychus ulmi* Koch 1836, Acari, Tetranychidae) with special Reference to the Influence of DDT.**—*Proefschr. Rijksuniv. Leiden*, 148 pp., 23 graphs, 202 refs. Leiden [1953]. (With a Summary in Dutch.)

*Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.), which is a serious pest of deciduous fruits all over the world, is characterised by the occurrence of fairly distinct generations, periods in which the eggs predominate alternating with periods in which the other stages do so, and by its lack of susceptibility to common insecticides. The author analyses the population fluctuations observed in the laboratory at Leyden and uses the results to investigate the effect of DDT on the mite. Its nomenclature and

bionomics and the population dynamics of animals in general are briefly reviewed from the literature, and features that distinguish *P. pilosus* from other species that have been investigated are discussed.

The numbers of eggs and active stages of the mite are affected by hatching, death and dispersion, but the last is considered to be of little importance. As a preliminary to analysing the population curve, those for hatching and for survival are considered separately. It is shown that temperature, humidity and light [cf. *R.A.E.*, A 42 181] all have an important influence on hatching of the winter eggs. If these factors are controlled, a regular curve results when total hatch is plotted against time in days, though the total percentage hatch may vary considerably, presumably owing to the previous history of the eggs. The hatching of the winter eggs follows a log-normal distribution, whereas that of later generations tends to normality. A hypothesis is formulated for the generation of curves of this shape.

To obtain information on mortality, mites were reared in isolation in the laboratory, and the numbers in the different stages on each day were tabulated for males and females and for those that did not survive to the adult stage. The results for mites that matured were plotted on graphs, and the resulting curves were S-shaped but could not be described by any simple function. The mean period of time spent in each stage was calculated from the tables and is shown to be longer for mites that did not mature than for those that did. Females appeared to spend longer in the immature stages than males, but statistical analysis did not show the difference to be significant.

Methods of measuring mite populations are reviewed, and the merits and shortcomings of that of counting the mites directly, which was the one adopted, are discussed, with a statistical analysis of its reliability. The curve of a population that developed from summer eggs isolated by spraying with parathion, which killed other stages, showed maximum populations of different sizes in consecutive developmental stages, owing to the fact that these have different durations.

In a mathematical treatment of the population dynamics, it is shown that the area between the population curve and the time axis for a given stage is a product of the original number of individuals, the mean length of the stage concerned, and the fraction surviving to the subsequent stage. This relation can be extended to describe egg production and adapted to compare two populations. It is pointed out that the theory is applicable to all animals with consecutive stages of development and generations that can be separated, and can be used in studies of the effects of toxicants and of ecological factors on population. It is limited to cases in which the influence of density-dependent factors is negligible; some other limitations are discussed and shown to be unimportant for *P. pilosus*.

A review of the literature shows that the mite population often increases after applications of DDT, and it is generally assumed that this increase is due to the selective destruction of predators by DDT. It is pointed out, however, that it has never been proved that predators were the factor limiting the population density of the mite in these cases, that a correlation between numbers of mites and of predators is not always found in practice and that the possibility of a direct influence of DDT on the mite cannot be ignored. In a field test, four apple trees were sprayed with parathion, which killed all mites not in the egg stage, all predators and most other insects, and two of them were sprayed eight days later with a wettable-powder suspension containing 0.1 per cent. DDT. Analysis of the population growth according to the author's theory indicated that the first generation of adults that developed after the DDT treatment laid 50 per cent. more eggs than did those on the trees not sprayed with DDT. In laboratory

experiments, egg production by female mites on leaves treated with low concentrations of DDT was in some cases more than half as much again as on untreated leaves, though at higher concentrations it was considerably smaller.

DE LOTTO (G.). **Three new Coccids (Hemipt.: Coccoidea) attacking Coffee in East Africa.**—*Bull. ent. Res.* **46** pt. 2 pp. 267–273, 3 figs., 5 refs. London, 1955.

Two of the new species described are *Pseudococcus latipes* and *Lecanodiaspis erratica*, from coffee in Uganda and Kenya, respectively. The third is *Ceroplastes luteolus*, which is the common *Ceroplastes* on coffee in Kenya, has hitherto been confused with *C. destructor* Newst., and was also collected on *Citrus* and *Markhamia platycalyx* at Nairobi. It was recognised as distinct during investigations made in view of the failure of parasites of *Ceroplastes* from coffee in East Africa to attack *C. destructor* in Australia [cf. *R.A.E.*, A **25** 11]. These involved comparison of material from Australia, Kenya and Uganda, as a result of which *C. ceriferus* (And.), which does not occur in East Africa, is recorded from Australia, *C. destructor* from Australia, Uganda and (on *Gymnosporia*) Kenya, and *C. brevicauda* Hall, which was described as a variety of *C. destructor* and is here raised to specific rank, from coffee in Uganda. The true *C. destructor* has not been taken on coffee in Kenya.

SOLOMON (M. E.) & ADAMSON (B. E.). **The Powers of Survival of storage and domestic Pests under Winter Conditions in Britain.**—*Bull. ent. Res.* **46** pt. 2 pp. 311–355, 2 pls., 4 graphs, 5 pp. refs. London, 1955.

The following is based on the authors' summary. The ability of nearly 70 species of insects that infest stored products, warehouses and other buildings to survive the winter in unheated premises in England was tested by exposing them for one or more winters in wooden screens and outbuildings at the Pest Infestation Laboratory, Slough. In general, cultures containing all developmental stages were exposed, and the chief aim was to demonstrate some survival or else the complete failure of the culture; conclusions about single stages were drawn where possible. The ability or failure of a species to overwinter may be affected by its cold-hardiness, the effects of previous conditions, differences between strains or races within it, the severity of the winter, period of exposure, moisture conditions, type of building, the degree of protection by materials in store and the biological heating of the immediate environment, and the importance of these factors is reviewed. The shortest experiment lasted 16 days and the majority about six months, and the lowest temperatures varied from 3°C. [37.4°F.] to -10°C. [14°F.]. The results, supplemented by those of Mansbridge [*R.A.E.*, A **25** 205], are shown in tables and discussed.

Nearly half the species survived even the severest tests, three were shown to be slightly less resistant, 13 were moderately susceptible and five very susceptible ones failed even in the least rigorous tests. Some of the results were anomalous. Although the hardiest group included species long established in the open in Britain and the susceptible group species originating in hot regions, some species adapted to life in warm regions, notably *Anthrenus vorax* Waterh. and *Trogoderma granarium* Everts, and some characteristically found in heated premises, such as these two species and *Ephestia kuehniella* Zell., *Anthrenocerus australis* (Hope), *Lepisma saccharina* L., *Laemophloeus turcicus* Grouv., and *Stegobium paniceum*

(L.), were nevertheless cold-hardy. Their absence or scarcity in unheated buildings is attributable not so much to the lethal effects of cold as presumably to other factors such as a preference for warm places and a more rapid rate of increase in them.

The hardy insects would always or nearly always be able to survive the winter in unheated buildings. Most of the susceptible insects would normally survive only in heated buildings or in materials heated through the activity of insects or micro-organisms or retaining their summer temperature in the depths of a bulk. The intermediate species would sometimes survive in unheated conditions and sometimes fail, according to the severity of the winter and the degree of protection given by the building and the material infested.

DUNN (J. A.) & WRIGHT (D. W.). **Population Studies of the Pea Aphid in East Anglia.**—*Bull. ent. Res.* **46** pt. 2 pp. 369–387, 11 graphs, 2 refs. London, 1955.

Population counts of *Macrosiphum* (*Acyrtosiphon*) *pisum* (Harris) on lucerne and, to a less extent, on peas, *Medicago lupulina* and sainfoin (*Onobrychis sativa*), were made in 1948–51 in eastern England [see also next abstract], and the trends on the different plants are outlined for each year [*cf. R.A.E.*, A **42** 127]. Populations varied considerably from year to year, but reached a peak in spring on lucerne, *M. lupulina* and sainfoin. On lucerne, which was periodically cut, the Aphids persisted throughout the growing season and tended to reach a second peak in autumn. Observations on peas were hampered because the crop was harvested shortly after the arrival of the migrant Aphids and the population was reduced by sprays of DDT applied in June–July against *Cydia nigricana* (Steph.). The factors that affected the numbers varied considerably in importance. Parasites, predators and fungous diseases had periods of special abundance, but appeared to exert much less marked control than physical agents. Heavy rain was one of the most consistent factors in population reduction. High temperatures retarded the rate of increase, but reduced or checked populations only where the plant was becoming less palatable. The cutting and removal of the crop eliminated many Aphids, but also removed the eggs of predators and parasitised Aphids, and the resultant absence of natural enemies and stimulation of new growth by cutting favoured the rapid increase of the remaining Aphids. If the crop was cut when the parasites were adult and the predators in the larval or adult stages, increased attack by natural enemies caused a further reduction in Aphids, for which the relative absence of shelter resulting from cutting was also unfavourable. Emigration of the alates depleted populations, and since the number of alates produced in spring varied widely from year to year, there was a variation in the importance of this factor. On lucerne, *M. lupulina* and sainfoin, the variation in the number of alates produced was greater from year to year than between plant species. Alates were also produced on lucerne in autumn, but not in summer. They appeared in summer on peas, but the period of growth was too short to permit the production of many.

DUNN (J. A.) & WRIGHT (D. W.). **Overwintering Egg Populations of the Pea Aphid in East Anglia.**—*Bull. ent. Res.* **46** pt. 2 pp. 389–392, 2 graphs. London, 1955.

The following is almost entirely the authors' summary. Observations on the winter eggs of *Macrosiphum* (*Acyrtosiphon*) *pisum* (Harris) on lucerne

and *Medicago lupulina* were made in eastern England in 1951 [cf. also preceding abstract]. On *M. lupulina*, mortality reached 83 per cent., but on lucerne it was apparently less. The two crops showed a wide discrepancy in the ratio of the total number of eggs present at the beginning of hatching to the number of fundatrices that successfully established themselves. The peak number of fundatrices on lucerne was three times the total number of eggs at the beginning of hatching, whereas on *M. lupulina* it was only half. Many more eggs than were recorded were undoubtedly laid on the lucerne plants, and many of the fundatrices subsequently found must have hatched from eggs that had fallen or been knocked off the plants. Counts of winter eggs are therefore unreliable for predicting populations in summer.

ALLEN (M. D.) & SELMAN (I. W.). **Egg-production in the Mustard Beetle, *Phaedon cochleariae* (F.) in Relation to Diets of Mineral-deficient Leaves.**—*Bull. ent. Res.* **46** pt. 2 pp. 393–397, 2 graphs, 5 refs. London, 1955.

The following is partly based on the authors' summary of this account of investigations on the effect of plant nutrients on the egg-production of *Phaedon cochleariae* (F.). Pairs of adults were confined with leaves of watercress (*Nasturtium officinale*) taken from plants grown in water cultures of known nutrient composition and allowed to feed for 11–14 days on leaves deficient in various elements and for another 11–14 days on leaves from plants grown in a complete nutrient solution, in that order or the reverse, and the numbers of eggs laid under both conditions were compared. Significant reductions in egg-production occurred when the leaves were deficient in nitrogen, phosphorus, potassium or iron, and the rate changed markedly within 2–3 days of varying the diet either to or from deficient leaves. The protein content of plants is adversely affected by deficiencies in these four elements, whereas the carbohydrate content is increased by a deficiency in nitrogen and decreased by deficiencies in potassium or iron. The rate of egg-production may therefore be simply related to the intake of protein.

COOMBS (C. W.) & FREEMAN (J. A.). **The Insect Fauna of an empty Granary.**—*Bull. ent. Res.* **46** pt. 2 pp. 399–417, 2 pls., 2 graphs, 6 refs. London, 1955.

The following is based on the authors' summary. A survey of an empty six-storeyed granary in western England that was built in 1884 and was in continuous use for grain storage between 1938 and 1951 was undertaken in the latter year to assess the size and composition of its insect fauna. The most important feature of the building was the presence of boarded-up cavities in the walls. Samples were taken at random from behind all walls, from parts of the grain-distributor system, and from certain other areas, and a list is given of the insects found, together with some reported to have been present during 1938–51 but not observed during the survey.

Many grain pests were found associated with the residues. Large populations had been built up in the wall cavities. The largest populations were behind the north and south walls, and, in general, the numbers of insects were greatest at the lower levels, these differences depending largely on the volume and quality of the food material present in the cavities. The increase in numbers was due both to increase in number of species and to increase in individuals of some species. *Hofmannophila pseudospretella* (Stnt.) predominated in the north wall, and *Calandra granaria* (L.) in the

south wall. Relative humidity probably governed the distribution of *H. pseudospretella*. In the east and west walls, where food material was less plentiful, the dominant insects were *Ptinus* spp., *Attagenus pello* (L.) and *Scenopinus fenestralis* (L.), which is a predator. When residues were in good condition, either *C. granaria* or *H. pseudospretella* predominated. As the percentage of finely divided material in the residues increased, so did the percentage of *Ptinus* spp. and *Tenebrio molitor* L.; finally, *A. pello* and *S. fenestralis* became dominant as the food value of the residues decreased still further, until in the end they were the only species left. The distributor system and the superficial areas examined supported the same type of population as those cavities in which either *Ptinus* spp. and *T. molitor* or *A. pello* were dominant.

The history of the granary as revealed by periodic inspections between 1938 and 1951 is given and related to the residual insect populations.

GRESSITT (J. L.). **Insects of Micronesia. Vol. 1. Introduction.**—viii + 257 pp., 49 figs., 22 maps, 9 pp. refs. Honolulu, Bishop Mus., 1954.

ESAKI (T.), BRYAN jr. (E. H.) & GRESSITT (J. L.). **Vol. 2. Bibliography.**—ii + 68 pp., 1 map. 1955.

These are the first two volumes of a work to which over 115 authors are to contribute and which will comprise a survey of the insects and almost all the other terrestrial arthropods of Micronesia. The area concerned includes the islands of the Mariana, Caroline, Marshall, Gilbert, Bonin and Volcano groups, and also Ocean, Nauru, Wake and Marcus Islands. The treatment is to be primarily systematic, but information on immature stages, habits, ecology and economic importance is to be included. The first two volumes are to be followed by two on arthropods other than insects, 15 on the insects, and one comprising a general summary of the fauna in which zoogeography and speciation will receive special emphasis. Each is to have its own index.

The introductory volume contains descriptions of the area, its geology, climate, flora and fauna, accounts of insect ecology on the atolls and high islands, a section on economic entomology, notes on collecting work done by various investigators, a bibliography of the literature cited, a list of Micronesian place names showing geographical position, and a general index. The section on economic entomology (pp. 170–193) is based on the literature and unpublished material and consists chiefly of a survey of pests arranged under the crops attacked, with locality records and notes on the provenance of introduced species and in some cases natural enemies, indigenous or introduced.

The second volume comprises a bibliography of Micronesian entomology, with an indication of papers referring to new species, and includes a list of the Japanese publications cited and an index to subjects with references to pertinent papers in the bibliography.

CUMBER (R. A.) & COWIE (J. D.). **Grass-grub Populations in Soils of the Manawatu Sand Country.**—*N.Z. J. Sci. Tech.* **35** (A) no. 5 pp. 465–470. Wellington, N.Z., 1954.

During a search for areas with high populations of grass grubs suitable for the release of parasites introduced from Australia for their control in pastures [cf. *R.A.E.*, A **42** 334], larvae of *Calonota* (*Pyronota*) *festiva* (F.) and *Costelytra zealandica* (White) were found to be numerous in the sandy soils of the Manawatu district, in the south of the North Island. A survey

was begun in the area in 1951, and the soil types and their plant cover, which consisted chiefly of grasses, are described and correlated with the species of larvae present. *Calonota* was the more abundant in almost all the soils in which it occurred and was of considerable economic importance.

LAMB (K. P.) & JACKS (H.). **Duration of Effectiveness of some organic Phosphorus Insecticides against *Myzus persicae* (Sulz.) on Swedes.**—*N.Z. J. Sci. Tech.* **35** (A) no. 6 pp. 550–554, 3 graphs. Wellington, N.Z., 1954.

The proprietary phosphorus insecticides used in the tests described were Isopestox (90 per cent. bis(monoisopropylamino)fluorophosphine oxide), Pestox 3 (66 per cent. schradan and related compounds), Sytam (70 per cent. schradan), Murphos 20 (an emulsion concentrate containing 20 per cent. parathion) and Thiophos (15 per cent. wettable parathion). In the first series, sprays of 0.1 per cent. Isopestox, Sytam and Thiophos were applied to swede plants in pots at the rate of 56 ml. per plant and prevented from falling to the soil. Immature apterae of *Myzus persicae* (Sulz.) were placed on the plants 24 hours later, and population counts were carried out at intervals. Thiophos reduced the population to a minimum in two days, but the numbers increased after the fourth day at a rate comparable with that on the control plants. Sytam and Isopestox reduced the population to a less extent, and the minimum was not reached till four days after treatment; the rate of increase on plants treated with Isopestox then became similar to that on the control plants, but Sytam continued to retard it until the tenth day.

In the second series, all five preparations were applied at 0.1 per cent. to the soil in the pots, 100 ml. being distributed evenly over the surface of each, and the observations repeated. Aphid populations on all treated plants decreased, and the minimum was reached on the second day for Murphos 20, on the fourth day for Isopestox, and Thiophos, and on the eighth day for Pestox 3 and Sytam. The rate of increase on plants treated with Pestox 3 and Sytam remained significantly lower than on the controls for 75 days, but increase on the others equalled that on the controls immediately after the minima were reached, though there were temporary reductions in numbers 6–8 and 10–16 days after treatment on plants treated with Isopestox and Murphos 20, respectively.

CLARK (P. J.) & JACKS (H.). **Arsenic and Lead Residues on Apples.**—*N.Z. J. Sci. Tech.* **35** (B) no. 4 pp. 311–314, 2 refs. Wellington, N.Z., 1954.

It is recommended in New Zealand that the last spray of lead arsenate should be applied to apple at least a month before harvest, so that residues of arsenic trioxide on the picked fruits should not exceed the official tolerance of 1.5 parts per million. In view of changes in application techniques that have taken place since this recommendation was issued, a survey of residues on apples was begun in 1951–52. In that season, the residues of arsenic trioxide on apples of several varieties from three orchards that received 5–7 applications of lead arsenate at 1.5 lb. per 100 gals., the last four weeks before harvest, varied from 1.5 to 3.9 p.p.m. In the following season, the residues on apples of one variety from trees sprayed 3–6 times were well below the tolerance only when applications were completed before the end of December, and these results were confirmed by analysis of apples from the three orchards previously surveyed. Statistical

analysis of the data indicated that the proportion of orchards in which the tolerance was likely to be exceeded was over 50 per cent. The residues on fruits that had passed over a felt-covered grading machine did not differ significantly from those on fruits taken straight from the tree, but apples from trees sprayed six times with lead arsenate at six times the usual concentration and one-sixth the normal volume showed reduced residues.

Since the ratio of lead to arsenic trioxide in lead arsenate is 2:1, arsenic-trioxide residues of 1.5 p.p.m. are likely to be accompanied by lead residues of 3 p.p.m. This amount was exceeded in 15 of the 21 samples analysed during the investigation, but was not reached when applications were completed before the end of December.

CUMBER (R. A.). **Studies on *Oliarus atkinsoni* Myers (Hemiptera: Cixiidae), Vector of the "Yellow-leaf" Disease of *Phormium tenax* Forst. IV. Disease-Vector Relationships.**—*N.Z. J. Sci. Tech.* **35** (B) no. 6 pp. 530–549, 2 figs., 3 refs. Wellington, N.Z., 1954.

In this fourth part of a series on *Oliarus atkinsoni* Myers, the vector of the yellow-leaf disease of *Phormium tenax* in New Zealand [*cf.* R.A.E., A **42** 209], the author describes laboratory experiments on the transmission of the disease by this Cixiid. In the course of 11 tests with adults, transmission was obtained when bugs collected from diseased bushes fed on healthy seedlings, males and females being equally effective, but examples from healthy bushes did not transmit after feeding on diseased plants; the growth of the seedlings was not affected permanently by the presence on them of moderate numbers of adults from apparently healthy bushes. The results were found to vary with the caging technique adopted; a satisfactory technique has apparently not yet been developed, and the length of life of the bugs in the tests was reduced. Six experiments with nymphs provided some evidence that the disease can be transmitted by nymphs from diseased bushes, but those from healthy bushes did not transmit after feeding on leaves from a diseased plant.

Many of the test plants died or became affected with sudden die-back during the work. The latter condition was not associated with the adults of *O. atkinsoni*, and no reliable conclusions could be drawn with regard to its relation to the nymphs; it is possible that die-back and yellow-leaf may be caused by the same pathogen attacking through different channels. The studies provided no confirmation of the earlier conclusion that yellow-leaf disease is caused by a virus [*cf.* **40** 95].

MARTYN (E. J.) & HUDSON (N. M.). **Control of the Armyworm, *Persectania ewingii* (Westw.) in Tasmania.**—*Tasm. J. Agric.* **24** no. 4 pp. 330–339, 9 figs., 3 refs. Hobart, 1953.

A widespread outbreak of *Persectania ewingii* (Westw.) in Tasmania in 1950–51 was followed by only localised damage in the following season, but adults were abundant from late September to late October 1952 [*cf.* R.A.E., A **43** 122] and larvae were present in increasing numbers from mid-November 1952 till mid-January 1953, after which the population rapidly decreased. The eggs are laid in the leaf sheaths of grasses. The larvae normally feed in the early morning and late afternoon and shelter beneath the grasses or weeds at other times, but if infestation is severe, feeding may continue throughout the day. Pupation takes place immediately below the surface of the soil, often in tufts of grass, or in deep cracks. Adults were again present from late December 1952 until May 1953. Full-fed larvae

found at the base of grass in mid-November undoubtedly belonged to the winter generation, but since no empty pupal cases were found they are thought not to have been associated with the adults present in September-October, the origin of which is unknown.

Damage by the larvae is most severe on oats, but grass seed crops, peas, barley, wheat and rye are also attacked, and some injury is caused to pastures. The larvae damage oats, rye-grass [*Lolium perenne*] and peas, chiefly by biting off parts of the panicle and the pods, but they also feed to some extent on the seeds of the first two, and damage to rye-grass from this cause is severe. On wheat, they chew off the leaves and attack the glumes of the basal spikelets. There is some evidence that the presence of dense undergrowth favours attack on crops.

Work on control in 1950-51 indicated that a dust of 2 per cent. DDT at 28 lb. per acre was highly effective against the larvae, and tests of lower rates of application and also of DDT sprays were begun in November 1952 on experimental plots of cocksfoot (*Dactylis glomerata*) and wild white clover (*Trifolium repens*). Applications were made on 25th November, when the larvae were not more than half grown and only the lower leaves of *Dactylis* were attacked, and counts of the living larvae in the treated and control plots were made on 15th and 16th December. A 5 per cent. DDT dust at 8 lb. per acre and an emulsified solution of DDT applied as a low-volume spray at  $\frac{1}{4}$  lb. actual DDT in 10 gals. per acre gave excellent control with no significant difference between them, but the dust at 4 lb. per acre was much less effective, though this was in part due to uneven application.

The intensity and extent of infestation in different parts of Tasmania during the outbreak are briefly reviewed. Infestation was particularly severe in the northern and central midlands, where rye-grass and oats were most affected, but defoliated crops produced normal yields of undamaged grain, and even heavily infested wheat crops showed no obvious reduction in yield. Dusts and sprays of DDT were applied with good results in many areas, and low-volume sprays of only 1.6 oz. DDT per acre were effective in two places, though they would probably not prevent re-infestation.

MILLER (L. W.). **The Control of Mites in Tasmanian Apple Orchards.**—*Tasm. J. Agric.* **24** no. 4 pp. 347-357, 16 figs., 4 refs. Hobart, 1953.

Work has been in progress on the control of *Paratetranychus pilosus* (C. & F.) on apple in Tasmania since 1948, and a review is given of the results up to the end of the 1952-53 season, some of which have already been noticed [*cf.* *R.A.E.*, A **41** 123; **42** 348]. The relative values of pale oil applied at the green-tip stage at 2.5 and 4 per cent. and a dormant application of 5 per cent. red oil were confirmed in 1949-50 [*cf.* **41** 123]. The addition of an aliphatic thiocyanate failed to improve the control given by pale oil in 1951-52, and there was little difference in effectiveness in 1952-53 between dormant applications of 5 per cent. red oil or 3 per cent. superior-type oil [*cf.* **31** 13] and treatment with 4 per cent. pale oil at the green-tip stage, though there was some indication of improved control from the superior-type oil applied at 2.5 and 3 per cent. at the green-tip stage. Experience over the five seasons indicated that dormant or semi-dormant applications of oil emulsion do not alone give adequate protection on susceptible varieties and in seasons favourable to the mite. A semi-dormant application of pale oil or superior-type oil is preferable to a dormant application of red oil, since it can be combined with a copper fungicide.

In work on summer acaricides, 0.0075 per cent. parathion gave effective control in 1949-50 when included in all three cover sprays against the

codling moth [*Cydia pomonella* (L.)] on trees that had not received dormant or semi-dormant ovicidal sprays, but not when applied only at the pink-bud and calyx stages, at the calyx stage and in the first cover spray, or in the first two cover sprays, though the last schedule was effective when it followed ovicidal treatments with 5 per cent. red oil or 4 per cent. pale oil; a single application of parathion at the pink-bud stage following pale oil at the green-tip stage permitted populations to build up during February–March. For general commercial use, concentrations of 0.01–0.0125 per cent. parathion were found to be necessary. Work in 1950–51 confirmed the necessity for including parathion in all three cover sprays on trees that had not received dormant or semi-dormant treatments and provided evidence, which was confirmed in the following two seasons, that 2.5 per cent. pale oil at the green-tip stage followed by 0.01 per cent. parathion in the first two cover sprays was more effective than a similar schedule in which parathion was included in the last two; control was adversely affected by the reduction in the concentration of pale oil. Parathion also gave good results in practice when properly applied before populations had increased and did not injure the foliage or fruits, though it intensified the fruit injury caused on one variety by a proprietary brand of wettable sulphur.

Three systemic insecticides, Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate), Pestox 3H (schradan) and Isopestox (bis(monoisopropylamino) fluorophosphine oxide), were tested in 1952, when applications were made on 15th January at 0.03, 0.1 and 0.05 per cent., respectively. Both Systox and Pestox 3H proved superior to 0.0125 per cent. parathion and gave good control, whereas Isopestox reduced populations until February but did not prevent subsequent increase. When analysed at harvest, the fruits from treated trees did not appear to contain any residues. A spray of 0.05 per cent. Sulphenone (p-chlorophenyl phenyl sulphone) applied in January was ineffective in 1952 and again in 1953, when it was compared with emulsion sprays of 35 per cent. diphenyl sulphone at 2.5 pints per 100 gals., 50 per cent. p-chlorophenyl benzenesulphonate at 0.05 per cent., 29.6 per cent. Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) at 1 pint per 100 gals. and 0.0125 per cent. parathion. Mites increased in numbers during late January and early February on trees sprayed with Sulphenone, diphenyl sulphone or parathion and continued to do so on those treated with parathion even after a second application on 26th February. Trees sprayed with Aramite were less severely infested, and those sprayed with p-chlorophenyl benzenesulphonate remained relatively free from attack and showed no spray injury.

TJOA TJEN MO. **Putul, kumbang-lundi padi gogo** (*Holotrichia helleri* Brsk.). [The Upland Rice Cockchafer (*Lachnosterna helleri*).]—*Contr. gen. agric. Res. Sta. Bogor* no. 130, 34 pp., 4 figs., 27 refs. Bogor, 1952. (With a Summary in English.)

The larvae of *Lachnosterna* (*Holotrichia*) *helleri* (Brenske) cause considerable damage to upland rice and sugar-cane in the plains in Central and East Java, and also attack other crops. Investigations on the bionomics of this Melolonthid in Central Java in 1929–35 showed that the adults, which are not injurious, emerge about August and leave the soil when the rains begin in October or later [cf. *R.A.E.*, A 17 630]. Pairing occurred two days later, and the oviposition period lasted 3–21 days, the females laying up to 46 eggs each. The larvae hatched in 10–11 days and became full-fed in about 5½ months. They then rested for 40 days, after which they pupated, the pupal stage lasting about two months.

Important control of the larvae is afforded by *Tiphia* (*Campsomeris*) *agilis* Smith, the percentage parasitism ranging from 7.2 to 59 in 1930 and from 7.1 to 52.8 in 1935. This Scoliid had one generation a year, the egg, larval and pupal stages lasting 2, 7-8 and 31-43 days, respectively.

Modern insecticides have not so far been tested against *L. helleri*, and the only methods of control recommended are collection of the adults, which are relatively inactive, flooding infested fields, and destroying the larvae by ploughing in the second half of the wet season.

FRANSSSEN (C. J. H.). **De levenswijze, oecologie en bestrijding van de kapok-topboorder** (*Alcidodes leeuweni* Hell.). [The Life-history and Control of the Kapok Top-borer (*Alcidodes leeuweni*).]—*Contr. gen. agric. Res. Sta. Bogor* no. 132, 36 pp., 8 figs., 23 refs. Bogor, 1952. (With Summaries in Indonesian and English.)

All stages of *Alcidodes* (*Alcidodes*) *leeuweni* (Heller) are described, and an account is given of observations on its bionomics on an estate in Central Java where this weevil had caused considerable damage to kapok in 1935. It was found that the egg stage lasted about four days, the full-fed larvae in the twigs rested for about eight days, and the pupal stage lasted about nine days, the adults not leaving the pupal chambers for about a week after emergence [cf. *R.A.E.*, A 21 156]. Complete development lasted 3-4 months. Both larvae and adults were injurious. The latter fed on the shoots and survived for an average of 150 days when the shoots were young and 70-90 days when they were older; females on young shoots laid an average of 250 eggs each, and those on older ones hardly any.

The eggs of the weevil were parasitised by the Eulophid, *Pareuderus torymoides* Ferrière, which attacked up to 24 per cent. of them on the estate in question and completed its development in about 11 days. The larvae were parasitised by *Apanteles* sp., and the pupae and also some of the larvae by *Eupelmus curculionis* Ferrière, but neither was of much importance. Factors that favour the weevil and possible means of control are briefly discussed.

FRANSSSEN (C. J. H.). **Voorzorgsmaatregelen tegen ziekten en plagen bij de katoencultuur in Indonesië**. [Precautionary Measures against Pests and Diseases in Cotton Cultivation in Indonesia.]—*Contr. gen. agric. Res. Sta. Bogor* no. 133, 18 pp., refs. Bogor, 1952. (With Summaries in Indonesian and English.)

Cotton is little grown in Indonesia, because of the damage caused to it by diseases and pests. Of the latter, *Platyedra gossypiella* (Saund.), *Earias fabia* (Stoll) and *Amorphaidea pectoralis* Mshl. are the most important [cf. *R.A.E.*, A 26 766], and possibilities of controlling them by government, communal and individual measures are discussed.

Vos (H. C. C. A. A.). **Introduction in Indonesia of *Angitia cerophaga* Grav., a Parasite of *Plutella maculipennis* Curt.**—*Contr. gen. agric. Res. Sta. Bogor* no. 134, 32 pp., 15 figs., 27 refs. Bogor, 1953. (With a Summary in Indonesian.)

*Plutella maculipennis* (Curt.) is an important pest of cabbage in the highlands of Indonesia. Investigations on its bionomics in Java showed that the life-cycle was completed in an average of 21 days at Patjet (at about 3,600 ft.), where the temperature varied from 16 to 25°C. [60.8-77°F.].

and in 15 days in the laboratory at Bogor (about 800 ft.), where it was 25–30°C. [77–86°F.] and oviposition was much reduced. *Angitia cerophaga* (Grav.) was introduced against it from Holland in 1928, but failed to become established, and since the difference in climate was thought to be the cause, a fresh introduction was made in 1950 from New Zealand, where conditions resemble more closely those in the uplands of Indonesia. Larvae of all instars were found to be attacked by the *Angitia* females in the laboratory at Patjet, those in the second and third being preferred, and the life-cycle lasted 18–20 days. The parasites were reared by a method that is described, and liberations were begun near Patjet in December 1950. Establishment resulted, and the percentage parasitism in 1951–52 averaged 72–82 or even more. Liberations were also successful in other areas in Java and in Sumatra, but failed where the cabbages were heavily treated with insecticides such as DDT. Where the parasite became established, the reductions in the *Plutella* population were considerable.

DRESNER (E.). **The present Status of economic Entomology in Indonesia.**  
—*FAO Plant Prot. Bull.* **3** no. 4 pp. 49–55, 6 refs. Rome, 1955.

The author gives a table showing the major pests of plantation crops in Indonesia, the type of damage that they cause, and the measures used for their control, and discusses the status and control of pests that attack the crops of smallholders. Potatoes, cabbage, soy beans and copra are in part exported. Potatoes are attacked by *Epilachna* sp., against which a DDT spray gives good protection, and cabbage by *Plutella maculipennis* (Curt.), which has developed resistance to DDT [cf. *R.A.E.*, A **41** 441] and against which *Angitia cerophaga* (Grav.) has been introduced [cf. preceding abstract]. *Phaedonia inclusa* (Stål) is injurious to soy beans [cf. **42** 218], and low-concentration sprays of 0.0063 per cent. DDT applied 15, 30 and 50 days after planting are recommended for control. *Artiona catoxantha* (Hmps.) is found on coconut on all the islands of western Indonesia, but outbreak areas are limited. *Apanteles artonae* Rohw. is an important parasite of this Zygaenid [cf. **39** 218].

Of the other crops on smallholdings, rice is mostly grown in small flooded plots and is then attacked by borers, in particular *Scirpophaga innotata* (Wlk.), and *Leptocorisa acuta* (Thnb.). In non-flooded fields, *L. acuta* is the most injurious pest, and Lamellicorn larvae [cf. **43** 349] and *Scotinophara* spp. also cause considerable damage. Crop losses due to *L. acuta* reached 50–100 per cent. in some flooded fields in Java in 1954, and it is estimated that they always exceed 10 and 20 per cent. in flooded and non-flooded fields, respectively. There is no recommended control for *Leptocorisa*, and none is practised against the borers, which are estimated to destroy 25 per cent. of the rice in flooded fields and 10 per cent. of the national production, though cultural control of *Scirpophaga* proved successful in the past [cf. **40** 150]. Maize is attacked chiefly by *Heliothis* sp. and armyworms, *Pyrausta nubilalis* (Hb.) being of minor importance, owing, it is thought, to the absence of food-plants in December–March. Infestation by *Etiella zinckenella* (Treitschke) severely affects the seed production of *Crotalaria* sp., which is grown for green manure and is also attacked by *Argina cribaria* (Cl.) and *Asota* (*Hypsa*) *alciphron* (Cram.). The most important pests of cotton, which is not now grown commercially in Indonesia [cf. **43** 350], are *Platyedra gossypiella* (Saund.), *Amorphoidea pectoralis* Mshl., *Empoasca* sp. and *Dysdercus cingulatus* (F.). Problems connected with the use of modern insecticides and the great need for trained workers are briefly discussed.

MILLER (P. R.). **Plant Disease Situation in the United States.**—*FAO Plant Prot. Bull.* **3** no. 4 pp. 58–59. Rome, 1955.

It is stated in the course of this survey that the warm late autumn of 1953 and the subsequent mild winter favoured the increase in Wyoming of populations of *Aceria tulipae* (Keifer), the Eriophyid mite that transmits the virus of wheat streak mosaic [*cf. R.A.E.*, A **43** 270, 277]. This disease was first observed in the State in 1951, though it had probably been present for some years. It spread in 1952 and 1953, and severe infection of winter wheat was observed in June 1954, when crop losses were greatest in the eastern counties. Infection was rather high in spring wheat sown late and near infected winter wheat, and traces of infection were observed in a few fields of barley and oats. Four annual grasses were found infected under natural conditions. Yellow-dwarf disease of cereals [*cf. 43* 268] was also common, particularly in barley and oats, and the virus was transmitted in tests by *Macrosiphum avenae* (F.) (*granarium* (Kby.)) and *Toxoptera graminum* (Rond.) to oats from diseased wheat plants collected in fields infected with wheat streak mosaic.

BENNETT (W. H.). **The Effect of Needle Structure upon the Susceptibility of Hosts to the Pine Needle Miner** (*Exoteleia pinifoliella* (Chamb.)) (*Lepidoptera: Gelechiidae*).—*Canad. Ent.* **86** no. 2 pp. 49–54, 5 figs., 6 refs. Ottawa, 1954.

*Exoteleia* (*Paralechia*) *pinifoliella* (Chamb.) is widely distributed in North America from southern Ontario to Georgia as a persistent, though not a serious, pest of pines, which it attacks at all stages. Forest trees are rarely killed by the infestation, though the foliage may become discoloured over large areas, but plantation and ornamental trees are sometimes killed or rendered unsightly. The females oviposit on the same trees year after year, and infestation thus remains localised. Of the pines native to the north, jack pine (*Pinus banksiana*) and pitch pine (*P. rigida*) are preferred, and red pine (*P. resinosa*) is attacked, though not severely. In the south, *E. pinifoliella* has been recorded from scrub pine (*P. virginiana*), shortleaf pine (*P. echinata*) and long-leaf pine (*P. palustris*). The Table Mountain pine (*P. pungens*) was extensively attacked at Syracuse, New York, and lodgepole pine (*P. contorta*) and, to a less extent, ponderosa pine (*P. ponderosa*) are both infested if planted within the range of the insect. Scots pine (*P. sylvestris*) is virtually immune from attack, even where its branches intermingle with infested branches of other species.

Near Syracuse, the adults appear in early June. Eggs are laid singly beneath the bark scales of twigs, and the larvae enter needles of the current year near the base and mine towards the tip, returning to the base in late summer. After moulting to the second instar, the larvae migrate to other needles in September and feed in the tips of one or two needles, overwintering in the tips in the fourth instar. Feeding is resumed in March, when about half the larvae remain in the same needles, eventually destroying most of the internal tissues, and the rest migrate to others, which they excavate. In late April or early May the fifth-instar larvae enter and excavate yet other needles in which pupation takes place in early May.

Observations on seven species of *Pinus* in plantations at Syracuse showed a correlation between the internal structure of the needles and susceptibility to attack, which was affected by the number, position and size of the resin canals in the needles and possibly by the vigour of the tree. The needles of *P. contorta* and *P. banksiana*, which were preferred, contain only two moderate-sized resin canals situated one at each side, and larvae of all instars fed with little or no interference from resin flow. Only one tree of

*P. pungens* was present, but it was well infested; the typical number of resin canals for this species is 2-7, but the needles examined contained only two. *P. ponderosa* was less heavily infested, except where growing under unfavourable conditions, and never severely damaged; the structure of the needles examined resembled that of the preferred species, but the canals were very large. The needles of *P. resinosa*, which was only slightly infested, contained two large canals situated ventrally that impeded the entrance of the larvae and the feeding of all instars except the last. Larvae sometimes entered needles of *P. sylvestris*, but were unable to survive in them. The needles contained 6-16 relatively large resin canals, and resistance to attack increased with the number present; there were many indications of feeding difficulties and of mortality due to copious resin flow. *P. rigida* is probably the natural food-plant in the north, but the few trees present in the plantations were uninfested. The needles contained 3-4 very small canals, and these are unlikely to interfere with feeding.

MACNAY (C. G.). **New Records of Insects in Canada in 1952: a Review.**—*Canad. Ent.* **86** no. 2 pp. 55-60, 7 refs. Ottawa, 1954.

Many of the records in this review have already been noticed [*R.A.E.*, **A** **41** 282; **42** 262, 332; **43** 72]. Those of insects new to Canada include *Pentarthrum huttoni* Woll., which was found in wooden flooring in Quebec in 1934 and again in 1952 and is known also from western Europe, and *Anthrenus vorax* Waterh., of which a severe infestation, believed to have originated in furniture transported from Missouri two years earlier, was found in a house in Alberta, and which is likely to become an important pest in heated buildings throughout the continent. The tobacco hornworm, *Protoparce (Phlegthontius) sexta* (Joh.), has occurred sporadically in Ontario during the past 20 years [*cf.* **37** 269] but caused extensive damage to tobacco there for the first time late in 1952, and the tomato hornworm, *P. (P.) quinquemaculata* (Haw.), which is a common pest of tomato and tobacco in southern areas of eastern Canada [*cf.* **29** 303; **31** 130; **38** 386], was found feeding on tomato in Saskatchewan. Other insects that have recently extended their range include *Hylemyia brassicae* (Beh.), which was recorded from Saskatchewan, on turnip, for the first time in 1952 and was already present in the other provinces; *Thylodrias contractus* Motsch., which infested an insect collection in Manitoba and had previously been recorded feeding on insect specimens and on the colour pigments of paintings in Ottawa in 1930, 1947 and 1950 and Montreal in 1947 and is known to feed on silk [*cf.* **25** 553]; *Phyllobius oblongus* (L.), which attacked elm and walnut in Ontario in 1950 and 1952, respectively; *Pulvinaria vitis* (L.), which is common in many parts of Canada and attacked vines in Newfoundland; *Rhyacionia buoliana* (Schiff.), which was found infesting seedlings of Austrian pine [*Pinus nigra*], Scots pine [*P. sylvestris*] and, to a less extent, red pine [*P. resinosa*] in nurseries in Prince Edward Island and Newfoundland, where it had probably been introduced with nursery stock and was readily controlled; and *Hypera nigrirostris* (F.), which significantly reduced the yield of red clover in Newfoundland and is of economic importance on clover elsewhere throughout eastern Canada.

BIGELOW (R. S.) & REIMER (C.). **An Application of the Linear Discriminant Function to Insect Taxonomy.**—*Canad. Ent.* **86** no. 2 pp. 69-73, 5 refs. Ottawa, 1954.

*Arphia pseudonictana* (Thos.) and *A. conspersa* Scud. have distributions in western Canada that overlap, and although individuals of these two

species of Acridid can be distinguished by an experienced taxonomist. they are sufficiently similar to render difficult their determination by an inexperienced worker.

Measurements of five characters were therefore made on 36 males of each species, from which were calculated their mean values and the standard deviations, and significant differences between the two species were found in the means of four of the characters. On the assumption that the mid-point between the specific means is the critical value for a particular character, a specimen would be misdetermined if its measurement differed from the mean of the species to which it did not belong by less than half the difference between the specific means. The probability of misdetermination is obtained by calculating  $t$ , equal to half the difference between the specific means divided by the standard deviation, and referring it to the normal probability integral table. The discriminating precision of the four characters separately ranged from 77 to 88 per cent.

Greater precision was obtained by combining two or more characters in a linear discriminant function, expressed as  $z = a_1 X_1 + a_2 X_2 + \dots$  where  $X_1, X_2 \dots$  represent the characters measured and  $a_1, a_2 \dots$  are appropriate weighting factors [which can be calculated from measurements on specimens that have been correctly determined]. When three characters (femur length, femur width and interocular space) were combined in such a function, individual males of either species could be determined with a discriminating precision of 98 per cent.

It is concluded that the use of discriminant functions may increase the speed and accuracy of determinations by inexperienced workers, facilitate the detection of small morphological differences, especially those concerned with the shape of structures or with characters that are widely separated spatially, and provide a method for the objective analysis of intraspecific variation.

HEIMPEL (A. M.). **A Strain of *Bacillus cereus* Fr. and Fr. pathogenic for the Larch Sawfly, *Pristiphora erichsonii* (Htg.).—*Canad. Ent.* 86 no. 2 pp. 73-77, 1 graph, 13 refs. Ottawa, 1954.**

During the summer of 1950, the author, working in Ontario, isolated several strains of *Bacillus cereus* from dead and dying larvae of *Pristiphora erichsonii* (Htg.). They were subsequently found to be identical, and preliminary feeding tests showed that the bacterium, which had hitherto been regarded as a specific pathogen of Lepidoptera [cf. *R.A.E.*, A 40 154; 42 170], was responsible for the mortality. Further tests were carried out in 1951 with suspensions of spore material prepared from the combined strains in sterile, distilled water and containing 10-11 million spores per cc. In laboratory tests, 10-15 larvae of *P. erichsonii* were confined, by means of a lantern globe with the smaller end covered with tissue paper, on larch foliage that had been dipped in a spore suspension; counts of dead larvae were made daily, and the body contents were examined for the presence of *B. cereus*. Mortality varied from 40 to 65.8 per cent., and its high level is attributed to the favourable temperature (about 27°C. [80.6°F.]) at which the experiments were carried out. There was no mortality among larvae on foliage dipped in water only.

Field tests were carried out in two larch stands, in each of which six branches were sprayed with a spore suspension and artificially infested with 200-300 young larvae of *P. erichsonii* on 9th July. A further application was made ten days later to all the treated branches in one plot and to four of the treated branches and five additional ones in the other. Dead larvae were collected daily until 30th July from trays placed beneath the trees.

Mortality ranged from 17.8 to 21.9 and from 30.9 to 33.5 per cent. on the branches that received only the first and only the second application, respectively, and from 19.8 to 38.9 per cent. on those that received both applications. There was virtually no mortality among the controls. The mean daily temperatures were consistently below 20°C. [68°F.] until 19th July, but fell within the range most favourable for *B. cercus* (20–30°C. [68–86°F.]) from 23rd July till the end of the month. The increased mortality after the second application is attributed to this rise in temperature. Both mean and maximum temperatures were positively correlated with daily mortality, and there was a striking decrease when the mean daily temperature did not exceed 20°C. for any appreciable length of time. However, spores applied to the branches that were treated only on 9th July may have been washed off by rain before favourable weather occurred. Dry spore material prepared in the spring of 1951 and stored in sterile vials was still effective in 1952.

BEIRNE (B. P.). **The *Prunus*- and *Rubus*-feeding Species of *Macropsis* (Homoptera: Cicadellidae).**—*Canad. Ent.* **86** no. 2 pp. 86–90, 29 figs., 11 refs. Ottawa, 1954.

The virus of peach yellows and little peach is known to be transmitted by at least one species of *Macropsis*, and it is therefore important that the species that feed on fruit trees should be readily identifiable. There has hitherto been some confusion among those that attack *Prunus*, since no satisfactory means of separating the adult Jassids was available. In this paper, the author gives characters differentiating the adults of the five species that attack *Prunus* or *Rubus* in North America, with notes on their food-plants and distribution and a key for their separation. *M. tristis* (Van D.), *M. trimaculata* (Fitch) and *M. insignis* (Van D.) all feed on plum (*Prunus* spp.), on which they may occur in mixed colonies. All three are widely distributed in the east-central and north-eastern United States, and the last two also occur in eastern Canada. *M. trimaculata* is the known vector of peach yellows and little peach [*cf. R.A.E.*, **A** **26** 173, etc.], but in view of its occurrence in mixed colonies, other species may also be involved. The adults feed only casually on peach, to which they transmit the virus from plum, and also on apricot and vines. Males in which the lateral processes of the apical region of the aedeagus are truncated instead of pointed, which it was formerly thought might represent a new species or variety [**35** 402], are normal ones in which the lateral processes have been broken off. This probably occurs during mating, since such examples were mostly collected during late July and August, whereas undamaged ones were commonest during June and early July.

The other two species are *M. quadrimaculata* Breakey, which is known from South Dakota, Nebraska, North Carolina, Tennessee and Colorado and has been recorded from wild plum [**35** 402], though the holotype and allotype bear labels indicating that they were collected on raspberry [*Rubus*], and *M. fuscata* (Zett.), which was recorded, for the first time in North America, on loganberry in British Columbia in July 1952 [*cf.* **42** 262].

HAFEZ (M.) & DOUTT (R. L.). **Biological Evidence of Sibling Species in *Aphytis maculicornis* (Masi) (Hymenoptera, Aphelinidae).**—*Canad. Ent.* **86** no. 2 pp. 90–96, 1 graph, 2 refs. Ottawa, 1954.

Observations were begun in 1952 on the bionomics of a complex of parasite species morphologically indistinguishable from *Aphytis maculicornis*

(Masi) that were introduced from various countries into California for release against *Parlatoria oleae* (Colv.) and are referred to as Indian *Aphytis*, reared from material originating in India, Pakistan and Afghanistan, Persian *Aphytis*, originating from Persia and Iraq, and Spanish *Aphytis*, from Spain [cf. *R.A.E.*, A 42 379]. A fourth strain, believed to be indigenous and designated Californian *Aphytis*, was reared from *P. oleae* in the San Joaquin Valley. All four strains were reared in the laboratory on *Hemiberlesia lataniae* (Sign.) on potato tubers.

The egg stage lasted three days in all but the Californian *Aphytis*, for which 4-5 days were required. Larval development lasted 7-9 days in the Persian and Indian *Aphytis* and 8-10 in the Spanish and Californian *Aphytis*, and the pupal stage occupied 6-9, 5-9, 8-11 and 8-10 days, respectively. There was a marked peak in adult emergence 17 days after oviposition in the Persian and Indian *Aphytis* and 20 and 23 days after oviposition in the Spanish and Californian *Aphytis*, respectively; it is stated in a footnote that adults that emerged after the peak were smaller and weaker than those that emerged earlier. In the Persian and Indian *Aphytis*, which were arrhenotokous, 63.3 and 67.5 per cent., respectively, of the population were females; in the Spanish *Aphytis* the proportion was 99.3 per cent. and in the Californian *Aphytis*, which appeared to be completely thelytokous, no males were found. There was no significant difference in the duration of adult life, which lasted about 33 days in the field in April and May and was longer in females than in males. The average number of progeny per female was 36, 37, 11 and 6 in the Persian, Indian, Spanish and Californian *Aphytis*, respectively.

Since the Persian and Indian *Aphytis* showed considerable similarity in their bionomics, an attempt was made to cross them. This was successful in both directions, but the percentage of females in the progeny of Indian females was reduced from 60.9 to 55.4 and that of Persian females from 69.9 to 30.7. A previous attempt at crossing these two, made by G. L. Finney in 1951, shortly after the parasites had been introduced and before there was any possibility of contamination of the stocks, was unsuccessful, and they may therefore represent distinct biological entities that have become accidentally mixed in culture. It is concluded on biological grounds, therefore, that the complex consists of at least three sibling species, namely a Persian-Indian, a Spanish and a Californian strain.

STULTZ (H. T.). **Note on Occurrence of *Agathis laticinctus* (Cress.) (Hymenoptera: Braconidae) as a Parasite of the Eye-spotted Bud Moth (Lepidoptera: Tortricidae) in Nova Scotia.**—*Canad. Ent.* 86 no. 2 pp. 96-98, 4 refs. Ottawa, 1954.

*Agathis laticincta* (Cress.) [cf. *R.A.E.*, A 43 305] has recently become the most important parasite of *Spilonota ocellana* (Schiff.) in orchards in Nova Scotia, and the effect on it of sprays applied for the control of various pests was investigated there in 1946-52. Of 926 adults reared from *Spilonota* shelters collected in 1946-48, over 99 per cent. were from orchards in which few or no arsenical sprays had been applied in recent years, and the only orchard sprayed with insecticides from which large numbers of the parasite were obtained was one treated almost exclusively with DDT since 1946. Data obtained from dissection of *Spilonota* larvae and examination of their shelters showed that the percentage of orchards with no parasitism declined from 46 in 1947-48 to 0 in 1951-52 and that the percentage in which parasitism was 50-93 per cent. increased over the same period from 3 to 30. This was associated with the gradual substitution of DDT for arsenical sprays in early applications against the codling

moth [*Cydia pomonella* (L.)] in 1946-49 and the gradual elimination of all insecticidal sprays after that date, and appears not to have been a result of the replacement of sulphur fungicides by other materials [cf. 43 265]. The increase in the parasite when DDT is used is probably due to destruction of its natural enemies. The mortality in cocoons of *A. laticincta* from orchards that received non-insecticidal or early applications of arsenical sprays averaged 45 per cent. in 21 orchards and 66 per cent. in 18 in 1952, as compared with only 5 in four that received DDT only. Though predators and parasites cause part of this mortality, the cause of much of it is unknown, the cocoons being apparently intact. Although DDT favours *A. laticincta*, it is not recommended for the control of *S. ocellana*, since it is insufficiently toxic and destroys many natural enemies other than *A. laticincta*. In recent years, the heaviest outbreaks of the pest have usually occurred where DDT has been substituted for arsenical sprays against *C. pomonella* for a year or two, and the degree of parasitism by *A. laticincta* appears to be unrelated to host density.

MACPHEE (A. W.) & SANFORD (K. H.). **The Influence of Spray Programs on the Fauna of Apple Orchards in Nova Scotia. VII. Effects on some beneficial Arthropods.**—*Canad. Ent.* 86 no. 3 pp. 128-135, 47 refs. Ottawa, 1954.

In this part of a series dealing with long-term investigations of the effects of sprays on the arthropod fauna of apple orchards in Nova Scotia [cf. *R.A.E.*, A 43 265, etc.], the authors summarise the preliminary results of tests of the effects of spray chemicals on the predators and parasites of the codling moth [*Cydia pomonella* (L.)], the eye-spotted bud moth [*Spilonota ocellana* (Schiff.)] and the oystershell scale [*Lepidosaphes ulmi* (L.)] and the predators of Aphids and phytophagous mites. The data were obtained on small plots consisting of 3-4 trees on which beneficial insects were numerous, and usually only one application was made, at concentrations recommended in official spray calendars or by the manufacturers. Additional information was obtained from other orchards. The results are given in tables, of which one shows for each beneficial species the pests attacked and the period of activity, and another the effect of the insecticides and fungicides. Similar information on toxicity from the literature is summarised in a third table.

The results obtained indicate that DDT and, to a less extent, parathion and sulphur, are extremely harmful to most beneficial species, that nicotine sulphate, lead arsenate, summer oil, Ovotran (p-chlorophenyl p-chlorobenzenesulphonate) and the fungicides Phygon (dichloronaphthoquinone) and ferbam [ferric dimethyl dithiocarbamate] are harmful to some and innocuous to others, and that Crag Fruit Fungicide (heptadecyl glyoxalidine acetate), Tag 331 (an organic mercury compound), copper fungicides and cryolite are relatively harmless.

LE ROUX (E. J.). **Effects of various Levels of Nitrogen, Phosphorus, and Potassium in nutrient Solution, on the Fecundity of the Two-spotted Spider Mite, *Tetranychus bimaculatus* Harvey (Acarina: Tetranychidae) reared on Cucumber.**—*Canad. J. agric. Sci.* 34 no. 2 pp. 145-151, 21 refs. Ottawa, 1954.

The following is based partly on the author's summary. Studies were conducted on the effects of various concentrations of nitrogen, phosphorus and potassium in nutrient salt solutions on the fecundity of *Tetranychus*

*bimaculatus* Harvey on cucumber plants grown on a vermiculite base to which the solutions were added. The concentrations of minor elements were not varied, and the nutrients supplied were measured. Populations of the mite were doubled when the initial concentration of nitrogen (210 mg. per litre) was doubled [cf. *R.A.E.*, A 40 386], and increased potassium also had a highly significant effect in increasing fecundity; when both were increased, there was a significant rise above that attributable to either element alone. Increased phosphorus gave a significant increase in fecundity in certain combinations.

FINLAYSON (D. G.) & NEILSON (C. L.). **Experiments on the insecticidal Control of the Tuber Flea Beetle, *Epitrix tuberis* Gent., in the Interior of British Columbia.**—*Canad. J. agric. Sci.* 34 no. 2 pp. 156–160, 1 fig., 3 refs. Ottawa, 1954.

The following is based almost entirely on the authors' summary. *Epitrix tuberis* Gentner has been a pest of potato in the interior of British Columbia since 1944 [cf. *R.A.E.*, A 42 171]. In experiments on its control in 1948–49, when there were two generations a year, dusts of 3–5 per cent. DDT, 5 per cent. chlordane, 10 per cent. toxaphene, 1–2 per cent. parathion and a mixture of 50 per cent. DDT, cryolite and talc (5:25:70) were applied to the potato foliage at various rates. The first three gave effective commercial control when applied at intervals of about ten days throughout the growing season; six applications of 5 per cent. DDT at 20 lb. per acre for the first two applications and 30 lb. for the rest was the most economical treatment. Most of the damage inflicted by the second-generation larvae was avoided by harvesting the crop before mid-September.

LOWMAN (M. S.), GERSDORFF (W. A.) & MITLIN (N.). **Pyrethrum Flower Toxicants . . .**—*Soap & chem. Spec.* 30 no. 8 pp. 139, 141, 143, 145, 159, 3 refs. New York, N. Y., 1954.

Pyrethrum flowers fermented in closed containers for six days or four, six or 12 months before being dried were found both by chemical tests and by spray tests against *Musca domestica* L. to retain more pyrethrins during storage for 34–58 months than controls dried at room temperature without previous fermentation.

CLARK (N.). **The Biology of *Hypericum perforatum* L. var. *angustifolium* DC. (St. John's Wort) in the Ovens Valley, Victoria, with particular Reference to entomological Control.**—*Aust. J. Bot.* 1 no. 1 pp. 95–120, 16 refs. Melbourne, 1953.

The following is virtually the author's summary. A study of the biology of *Hypericum perforatum* var. *angustifolium* in the Ovens Valley, Victoria, has shown that the weed possesses characteristics that make it a difficult species for effective entomological control [cf. *R.A.E.*, A 42 175]. They include the ability to prosper under a diversity of environmental conditions after successful establishment from seed; a great capacity for vegetative reproduction by means of suckers [cf. 42 74]; and a delay in the germination of a proportion of the seed for at least six years, probably owing to the presence of an inhibitor in the sticky exudate of the seed capsule. The problem of control is made more difficult by the unfavourableness of a large part of the area for the growth of other herbaceous plants capable of competing effectively with either mature *Hypericum* or its seedlings.

The leaf-eating beetles, *Chrysomela quadrigemina* Suffr. (*gemellata* Rossi) and *C. hyperici* Forst., introduced against it, differ greatly in their ability to destroy well-established stands of the weed. The susceptibility of mature *Hypericum* to defoliation depends on environmental conditions, such as the physical condition of the soil, which determine the life span of the individual crown and the rate and amount of vegetative reproduction. *C. hyperici* is highly destructive only in stands characterised by large crowns and limited vegetative reproduction [42-74], whereas *C. quadrigemina* can eliminate any type of stand occurring in treeless areas. The difference between the insects is due to the fact that *C. quadrigemina* can sustain the process of defoliation much longer than *C. hyperici*. Environmental conditions most favourable for the initial multiplication of both insects happen to occur in those sites in which the established plants are of the type most susceptible to insect attack and where seedling regeneration is most likely to be suppressed by the associated flora. The stands of *Hypericum* that occur in areas less favourable for the initial colonisation by the insects are generally more resistant to defoliation. Some of these stands, such as those present in *Eucalyptus* forest, cannot be destroyed by hand defoliation sustained for periods longer than those for which the insects can maintain the process. Frequently, plants capable of replacing mature *Hypericum* damaged by insect attacks or of suppressing seedling regeneration are scarce or absent, as in many gold-dredging areas. Consequently, if the insects do succeed in destroying the original stands in such sites, the weed has a good chance of successful regeneration from seed. In many such areas in which the weed was destroyed in 1946 or 1948, *Hypericum* is already re-established as the predominant plant. It has either achieved its former density or is well on the way towards doing so.

GRYLLS (N. E.). **Rugose Leaf Curl—a new Virus Disease transovarially transmitted by the Leafhopper *Austroagallia torrida*.**—*Aust. J. biol. Sci.* 7 no. 1 pp. 47–58, 4 pls., 15 refs. Melbourne, 1954.

Examples of *Austroagallia torrida* Evans, which is no longer considered by its author to be referable to *Nehela* [cf. R.A.E., A 30 154], were collected in Canberra on lucerne infected with the virus of witches' broom disease and transmitted mild virus symptoms distinct from those of the latter or any other known virus when established on *Datura tatula* in the laboratory; similar symptoms were later produced by further examples of this Jassid collected on lucerne elsewhere in the Capital Territory and in New South Wales. Examples collected in April 1952 transmitted no symptoms to susceptible plants, but symptoms appeared in March 1953 on carrot seedlings on which their progeny were caged. It was therefore concluded that the virus was new and was transmitted through the egg of the insect vector. In experiments, the virus was not transmitted by mechanical inoculation, by *Orosius argentatus* Evans, a vector of witches' broom [cf. 41 404], or by means of dodder (*Cuscuta*); it was successfully transmitted by *A. torrida* to lucerne, tomato, carrot, parsnip and 12 other plants in seven families and by grafting to tomato and *D. tatula*, but by neither method to eight other plants including potato, pepper (*Capsicum annuum*), egg-plant (*Solanum melongena*), tobacco and beet. *A. torrida* transmitted after feeding for periods ranging from 60 minutes to four days on the source plants, and identical symptoms were produced when the source plants were infected with witches' broom. In the latter case, the virus was probably already present in the insects and was not acquired from the test plants; no transmission of witches' broom occurred. Confirmation of transovarial infection was obtained in 1952–53, when nymphs reared on

a healthy plant from eggs laid by females that had fed for four days on infected plants transmitted the virus to healthy plants to which they were transferred before having fed; the symptoms appeared after about  $2\frac{1}{2}$ –3 months, and the percentages of healthy plants that became infected in two tests were 42 when the nymphs were transferred singly and 74 when they were transferred in batches of five. Transovarial infection is known to occur in only four Jassids [cf. 29 272; 39 323; 43 266].

The most characteristic symptoms of the disease, for which the name rugose leaf curl is proposed, included severe rugosity, twisting and curling of the leaves, and marginal chlorosis. In addition, vein-clearing or netting, interveinal chlorosis, proliferation of shoots, and the production of stunted flowers were observed in various plants. Anatomical studies of the stems of infected tomato and *Physalis floridana* indicated that the virus affects the phloem. The symptoms on lucerne were very similar to those caused by a mild strain of witches' broom observed by Helms, but those on tomato differed considerably, and Helms' mild strain can be transmitted by dodder. Symptoms of rugose leaf curl were not observed on lucerne in the field, but they may have been confused with those due to the mild strain of witches' broom.

*A. torrida* is widespread in lucerne fields and probably occurs in every mainland State of Australia, but was considerably less numerous than *O. argentatus* in a survey in the Capital Territory during 1947–48. Unlike the latter, it breeds on lucerne. In the laboratory, its preferred food-plants included *Malva parviflora*, *Datura*, red clover (*Trifolium pratense*), lucerne and carrot, on all of which it fed and bred readily. Three complete but overlapping generations developed in the year in the insectary. Eggs were laid in the stems, petioles and veins of the leaves and did not develop unless fertilised. The nymphs hatched in 10–14 days, except in winter, and each of the five nymphal instars lasted 5–7 days. Adults were taken in every month except January and August and were most numerous in April in 1947–48, but the winter is probably passed principally in the egg stage. Of 108 feeding tracks in a portion of petiole, 51 per cent. terminated in parenchyma, 10 per cent. in xylem, 34 per cent. in phloem and the rest in both xylem and phloem.

ERLICH (S.). **The Pasture Cockchafer *Aphodius howitti*, Hope, in Victoria. Biology, economic Importance and Control with the newer Insecticides.**—*J. Dep. Agric. Vict.* 52 pt. 3 pp. 134–144, 9 figs., 1 map, 4 refs. Melbourne, 1954.

An account is given of experiments in 1951–52 on the control of *Aphodius howitti* Hope in improved pastures in Victoria, with notes on its bionomics [cf. *R.A.E.*, A 31 264; 39 39, 408] and a map showing its distribution in the State. A survey in 1949–51 showed that this Aphodiid occurs in areas in which the average annual rainfall is 20 ins. or more. Where larval populations in early autumn reach or exceed 75 per sq. ft., the pasture may be destroyed for the season. A survey of 149 sheep farms in the Western District in 1947 showed that 95 per cent. of them had at some time been infested and that over 5 per cent. of the total area in about a third of them had been seriously damaged in one year.

DDT applied in a dust at 1 lb. per acre in autumn or 2 lb. in winter has been recommended for control on the basis of experience since 1947 [cf. 42 47], and further tests of insecticides were made in 1952 and 1953. In 1952, the materials were applied, in the amounts stated, as dusts in 100 lb. superphosphate or as sprays in 100 gals. water per acre. In a preliminary test in which dusts were applied to soil in pots and the larvae provided

with subterranean clover [*Trifolium subterraneum*] and Wimmera rye-grass [*Lolium rigidum*] as food, aldrin at 1 and 3 lb. killed or mortally affected all those present in seven days, and 1 and 0.25 lb.  $\gamma$  BHC (in a wettable powder), 3 and 1 lb. dieldrin, and 2 and 1 lb. DDT similarly affected 87.5, 54.2, 75, 70.8, 58.3 and 29.2 per cent. of them, respectively; all the materials but DDT at 1 lb. killed or affected all the larvae in 22 days. In a similar test, the percentages of larvae killed or affected after 45 days by emulsion sprays of DDT at 2 and 1 lb. and of chlordane at 10 lb. were 73.2, 53.6 and 46.4, respectively, as compared with 26.8 for no treatment.

A preliminary field test with the dusts was carried out in a pasture that had been completely denuded in the previous year, but was less severely infested in 1952. Applications were made on 8th May, when the larvae were small, and examination of soil samples showed that the number of living individuals present three weeks later was reduced from 9.8 to 0.2, 0.7, 2.6 and 2.9 per sample by 1 lb.  $\gamma$  BHC, 3 lb. aldrin, 2 lb. DDT and 3 lb. dieldrin, respectively. In another district, in which about 60 acres of pastures had been completely denuded, dusts were applied on 3rd July, when most of the larvae were fully grown but still feeding, to plots on which about 50 per cent. of the vegetation had been destroyed. The reductions in population in the treated plots were not significant after 18 days, but were significant for 4 oz.  $\gamma$  BHC and 1 lb. aldrin or dieldrin after 39 days and for these materials and 2 lb. DDT, but not 2 lb. crude BHC (equivalent to about 4 oz.  $\gamma$  BHC) after 67 days. In both tests, the growth of the vegetation was improved by dusting, as compared with treatment with superphosphate only, and there was a clear line of demarcation between treated and untreated areas. The plots treated in July showed no damage and supported only a few living larvae in September 1953, when the injury varied from 20 to 75 per cent., many larvae were present, and *Erodium* sp. appeared to be replacing subterranean clover in the untreated plots and those that received superphosphate only. The speed of action of the insecticides was tested at a point where larvae were advancing from denuded into uninfested soil. Dusts were applied on 7th July, and by 21st July the larvae had halted in the plots treated with aldrin or dieldrin at 1 lb. and  $\gamma$  BHC at 4 oz., had advanced about six inches in the plot treated with DDT at 2 lb. and further in the one treated with crude BHC at 2 lb., and had completely denuded a plot treated with superphosphate only and one left untreated. In September 1953, the plots dusted with aldrin, dieldrin and  $\gamma$  BHC were still uninjured, and the damage on the others amounted to 50, 20, 70 and 60 per cent., respectively.

In 1953, the dusts were diluted in 100 lb. pyrophyllite per acre, and the sprays were again applied at 100 gals. water per acre. In the first test, applications were made on 15th May, when the larvae were mostly in the second instar, and one inch of rain fell four days later. After 11 days, dusts of  $\gamma$  BHC at 4 and 2 oz., and after 26 days DDT at 1 lb. and dieldrin but not aldrin at 8 oz., had caused significant reductions, and the control from 1 lb. DDT and  $\gamma$  BHC at both rates was significantly superior to that from dieldrin. After 46 days, all these treatments, but not aldrin at 4 oz., gave significant control; DDT and  $\gamma$  BHC at both rates were still the most effective and did not differ significantly from one another. Differences in the pasture on treated and untreated plots were apparent by this date, and by 8th September growth on those treated with DDT and  $\gamma$  BHC was markedly superior to that on the rest. Since  $\gamma$  BHC gave good results at low rates of application, a comparative test with this material at 4, 2 and 1 oz. and DDT at 2 lb. was made in a pasture showing widespread damage. Treatments were applied on 10th June. DDT and 4 oz.  $\gamma$  BHC gave highly

significant control after 41 days and virtually complete control after 63, when highly significant reductions were also given by  $\gamma$  BHC at the two lower rates. A difference in the appearance of the treated and untreated plots became apparent three weeks after application, and after six weeks, when the control plots were practically bare, the vegetation in the treated plots was 2-5 ins. high; the growth in those that received DDT or 4 oz.  $\gamma$  BHC was slightly superior to that in the other treated plots. These results were confirmed in demonstration plots sprayed on 10th July with  $\gamma$  BHC at 1, 2, 4 and 16 oz. and DDT at 2 lb. In a discussion of the cost of treatment,  $\gamma$  BHC at 2 or 4 oz. per acre is shown to be considerably cheaper than DDT at 2 lb.

HOGAN (T. W.). **Control of the Harlequin Bug** (*Dindymus versicolor* H.Sck.).—*J. Dep. Agric. Vict.* **52** pt. 4 pp. 191-192, 2 figs. Melbourne, 1954.

Insecticides have so far not proved highly effective against *Dindymus versicolor* (H.-S.), which attacks most vegetable crops, fruit trees and ornamental flowering plants as well as weeds in Victoria [*cf. R.A.E.*, A **21** 554]. An emulsified solution of 0.2 per cent. DDT was the most effective known, but was unsatisfactory against the adults of the Pyrrhocorid, and the best control was given by the destruction of adults and nymphs overwintering in wood heaps, at the bases of fences and in similar situations; the removal of weeds and rubbish was also recommended. The effectiveness against the adults of some recently developed organic insecticides was accordingly investigated in the laboratory, and some observations on bionomics were made. The eggs are laid in the soil in spring, and the number produced per female varied from 60 to 80. A second generation developed in late summer or autumn, and whereas the later adults themselves overwintered, the earlier ones produced progeny of which some overwintered as nymphs and some as adults. The insecticides were applied topically in water emulsion at various concentrations and dosages, and the results are given in a table. Lindane [almost pure  $\gamma$  BHC] was significantly superior to DDT, aldrin, toxaphene and chlordane, and in a field test a spray containing 0.03 per cent. lindane gave complete control and prevented reinfestation for three days.

GELLATLEY (J. G.). **Control of Cabbage White Butterfly**.—*Agric. Gaz. N.S.W.* **65** pt. 4 pp. 182-184, 208, 4 figs., 1 ref. Sydney, 1954.

In view of complaints in New South Wales that the spray of 0.1 per cent. DDT recommended against *Pieris rapae* (L.) on cabbage and cauliflower [*cf. R.A.E.*, A **39** 41] did not give adequate control, the effectiveness of this and other treatments was investigated on cauliflower in 1953. The materials tested were emulsion sprays containing 0.1 per cent. DDT, 0.0125 per cent. parathion or a combination of the two, a dust containing 2 per cent. DDT and 0.26 per cent.  $\gamma$  BHC, and a spray of 0.05 per cent. Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate). Applications were begun on 19th February on cauliflowers planted out on 7th January and repeated at weekly intervals to give thorough coverage, especially of the lower surface of the leaves, except in the case of Systox, which, being a systemic insecticide, was applied to the tops of the plants only, at intervals of 2-3 weeks. The cauliflowers were cut between 30th March and 27th April, and virtually complete control was given by all materials except

Systox, plants sprayed with this and the untreated controls being severely damaged. Larvae in these plots were parasitised by *Apanteles glomeratus* (L.) throughout the experiment, but the control afforded was negligible.

BUZACOTT (J. H.). **Insects associated with Sugar Cane in New Guinea.**—*Tech. Commun. Bur. Sug. exp. Stas Qd* 1953 no. 2 pp. [1 +] 23–30, 9 refs. Brisbane, 1953.

The author gives a list of insects collected in 1951 during a survey of sugar-canes in New Guinea, where the crop is not grown commercially, together with notes on the distribution of the commoner ones and on the relation of some to similar species on sugar-cane in Queensland. The insects feeding on the cane included a Lamiid of the genus *Orinoeme* near *O. lineigera* Pasc., which damaged the heart leaves, the Eumolpid, *Rhyparida morosa* Jac., and a Hispid subsequently described by Uhmman as *Brontispa lateralis*, both of which fed on the leaves, the weevils, *Rhabdoscelus obscurus* (Boisd.), which was common on the coast, and *Gloeodema spatula* Woll., a single example of which was found feeding on the inside of the leaf sheath, the moth-borer, *Phragmatiphila truncata* (Wlk.), which was the most important pest observed, *Cosmopteryx* sp., which tunnelled in the mid-ribs of the leaves and was common, *Aphis sacchari* Zhnt., small colonies of which were numerous, *Oregma lanigera* (Zhnt.), which infested some varieties but appeared to avoid others in the same garden, *Saccharicoccus* (*Trionymus*) *sacchari* (Ckll.), which was common on the coast, *Neomaskellia bergii* (Sign.), and two unidentified species of *Phaenacantha*, one of which appeared to resemble *P. australiae* Kirk., which infests sugar-cane in Queensland, and two of *Tettigella*. Fiji disease was common throughout the areas visited, and a species of *Perkinsiella* very similar to *P. saccharicida* Kirk. and thought to be *P. lalokensis* Muir, was found associated with both healthy and diseased canes. This Delphacid was widely dispersed from the coastal areas up to more than 6,000 ft. above sea level and is probably the major vector of the disease in New Guinea, though other species of the genus may also be involved.

WISE (K. A. J.). **Occurrence of the Oak Blotch Miner *Lithocolletis messaniella* Zeller (Lepidoptera: Gracillariidae) in New Zealand.**—*Trans. roy. Soc. N.Z.* 81 pt. 1 pp. 65–66, 1 pl., 1 fig., 4 refs. Wellington, N.Z., 1953.

Moths reared from blotch mines on the leaves of oak collected at Gisborne, New Zealand, in February 1951 and later also from chestnut were identified as *Lithocolletis messaniella* Zell., which has not previously been recorded from that country. Its distribution, food-plants and distinguishing characters are briefly reviewed [*cf. R.A.E.*, A 43 234].

SMITH (A. J.). **The Citrus Red Mite.**—*Fmg in S. Afr.* 28 no. 331 pp. 340, 344. Pretoria, 1953.

*Paratetranychus* (*Metatetranychus*) *citri* (McG.) was found in South Africa for the first time in 1950, in a *Citrus* orchard in the Rustenburg area, and had apparently spread to all the main *Citrus*-growing areas of the Transvaal, but not to Natal or Cape Province, by 1953. The egg stage of this mite is stated to vary in duration from six days in summer to 20 or

more in winter, and the larval and two nymphal stages each last two days or more according to temperature. Eggs are usually deposited 2–3 days after the mites become adult, and the life-cycle from egg to egg may be as short as 14 days under optimum conditions. Populations are usually highest in spring and autumn; breeding is retarded by the cold in winter, and high summer temperatures cause heavy mortality. The mites feed on the fruits, young twigs and leaves, but cause most damage to the leaves, which drop if infestation is heavy. Infestation also results in die-back of the twigs and dropping of the fruits, and considerable losses of navel oranges due to the latter have been experienced in autumn. The effectiveness of chemical treatments against the mite is briefly reviewed.

DÜRR (H. J. R.). **Parathion Spray Residue on Apples and canned Peaches.**  
—*Fmg in S. Afr.* **29** no. 337 pp. 231–232, 1 ref. Pretoria, 1954.

In the western Cape Province of South Africa, two spray applications of parathion are made against *Tetranychus bimaculatus* Harvey and *Bryobia praetiosa* Koch on apple and peach and sometimes against *Eriosoma lanigerum* (Hsm.) on apple. It has been suggested that the fruits should be fairly safe for eating or (in the case of peaches) canning if the last application is made at least three weeks before harvest, and tests were therefore made to determine the quantities of parathion to be expected on apples at various times after spraying and whether parathion will be present on peaches that are canned after receiving the usual treatment. Apples from an orchard that had been sprayed with 1.5 lb. 15 per cent. wettable parathion per 100 gals. on 1st and 14th April 1953 were found to contain 0.63, 0.39 and 0.28 parts per million parathion 8, 14 and 21 days after the second spray. These amounts are extremely small, but the low residue on the first test date may have been partly due to rain after each application. Fruits picked on 26th March from peach trees that received the same spray on 16th and 24th March contained 0.29 p.p.m. parathion before canning and less than 0.01 p.p.m. (the smallest quantity that could be detected) after it. No taint was noticed in the canned peaches, and it is concluded that parathion does not persist after canning.

COATON (W. G. H.). **Veld Reclamation and Harvester Termite Control.**  
—*Fmg in S. Afr.* **29** no. 338 pp. 243–248, 5 figs. Pretoria, 1954.

The author points out that whereas the activities of harvester termites [species of *Hodotermes*] are beneficial in maintaining soil fertility in undisturbed veld in South Africa, they are extremely harmful on land that has been overgrazed, since they lead to the destruction of the remaining grass, cause soil erosion and encourage less desirable vegetation [*cf. R.A.E.*, **A 38** 135, etc.]. The problem is particularly serious in Zululand, where large areas of pasture have been destroyed and the termites are still increasing. If the termites are controlled, the grass readily becomes re-established, despite grazing by stock, so that control is very desirable in the interests of land reclamation. A simple method is the destruction of the termites by a bait of chopped hay soaked in sodium-fluosilicate solution [*cf. 38* 136–137], and methods of preparing the bait on a large scale are described. If prepared immediately before use, it need not be thoroughly dried, since the termites will take it slightly damp. The bait has been used with good results on a large scale in Zululand since 1950, and although cattle have been allowed free range over the treated areas, no case of poisoning has been reported.

DEL VALLE Y MARCH (R. G.). **Escaravelho preto do milho** (*Heteronychus licas* Klug) **Coleoptera, Scarabaeidae, Dynastinae.** [The Black Maize Beetle, *H. licas*.]—*Gaz. Agric.* 6 no. 62 pp. 194–196, 1 fig. Lourenço Marques, 1954.

Since 1946, damage to crops by adults of the Dynastid, *Heteronychus licas* (Klug), has become widespread and serious in Mozambique, particularly in the valley of the Incomáti River, though it does not occur every year. In 1951–52, severe injury was caused to young maize, rice and sugarcane, and the first two crops had in consequence to be replanted several times. The attack begins at the onset of the rainy season in October–November, when the crops are young, and continues until February–March. The preferred food-plant is maize. The larvae develop in wet low-lying areas beside the river, feeding on organic matter in the soil, and the adults emerge just before the rains and fly to drier areas, appearing suddenly in large numbers. They remain in the soil by day, feeding just below the surface, and move from plant to plant by night. Larvae, pupae and adults are rapidly killed by exposure to sunlight, and frequent ploughing in June–August, which also exposes them to birds and other predators, is recommended. The general advantages to be gained from adequate drainage and irrigation in the south of the territory are briefly discussed. Where irrigation is possible, crops should be sown early so that the plants are well developed by the beginning of the rains. Trap-crops of maize are useful and should be sown every 15 days from the end of September. A summary of the control measures recommended in Southern Rhodesia is appended [cf. *R.A.E.*, A 13 351].

FÉRON (M.). **Le développement et la pullulation de la mouche de l'olive** *Dacus oleae* Gmel. et de son parasite *Opius concolor* Szépl. en Tunisie. (Mission de prospection, octobre-décembre 1953.)—*Rev. Path. vég.* 33 fasc. 1 pp. 3–30, 5 figs., 1 map, 9 refs. Paris, 1954.

Tunisia is the only olive-growing country of the Mediterranean basin in which *Dacus oleae* (Gmel.) is not a major problem. This is thought to result from a combination of the climate, the cultural methods employed and parasitism by *Opius concolor* Szépl., and a survey was made throughout the olive-growing areas in October–December 1953 to estimate the importance of these factors. Details are given of the relief and climate of the districts visited, which fell into two groups separated by the mountains, those to the south being exposed to hot dry winds from the Sahara and having very light rainfall, long dry periods and extremes of temperature, and those to the north having a milder climate of the Mediterranean type.

Olives are grown almost exclusively for oil in Tunisia, and the infestation percentages observed in the various districts are shown in a table; they were in general low but reached 50 or more in a few localities, chiefly in varieties with large fruits. The only region in which there was no attack was the forest of Sfax, an extensive planting on the east coast consisting of trees of one late variety, in which infestation normally begins at the end of November and is considerable in December–January. Its absence in 1952–53 was attributed chiefly to the exceptionally dry season, the olives being too small and hard to permit oviposition or larval development, but other favourable factors were the wide spacing of the trees and the absence of ground vegetation. At Enfidaville, to the north, infestation was high in irrigated groves surrounded by hedges of *Opuntia* and consisting of varieties of which some had large fruits. At Sbeitla, in the interior, the percentages

of attack were 3.3, 6.5 and 9.4 on 16th and 18th November and 11th December, respectively, on a late variety, 2 and 58.8 on 17th–18th November on two varieties picked in December, 25 on 11th December on the second of these, and 1.4 on 18th November on a fourth variety. The two varieties picked in December were similar in almost all respects, and it is thought that the preference for one of them may have been due to properties of the epicarp and flesh of the fruits [cf. *R.A.E.*, A 43 30].

Information on the distribution of *Opius concolor* was obtained by direct observation on the trees and by rearing from olives taken to the laboratory. The results are given in a table and showed that the parasite was present in almost all the districts visited, even on isolated trees. The main exception was the forest of Sfax, though *O. concolor* is reported to appear there whenever substantial populations of *Dacus* are present. The percentage parasitism was highest at Enfidaville, and examination on 20th and 29th December, 11th January and 17th February of puparia from olives picked on 15th December showed that 87.7, 42.3, 18.1 and 0 per cent. were parasitised, respectively. The decrease was expected, since it is probable that *Opius* attacks only larvae in the third instar and possibly those in the second. Counts of parasitised puparia were facilitated by the finding that light-coloured ones gave rise to *Dacus* and dark ones to *Opius*. The parasitised puparia showed no deformation such as that recorded for *Ceratitis capitata* (Wied.) in Morocco, and it is therefore thought that *O. concolor* may be a specific parasite of *D. oleae* that has become adapted to *C. capitata* under the particular conditions of the Sous [cf. 42 406]. It proved to be of less importance than had been thought, being favoured mainly by conditions that also favoured *D. oleae*.

It is pointed out from consideration of the climatic conditions of Tunisia that *Dacus* has no difficulty in surviving through the winter, since low temperatures are rare and olives are available until the spring. Development is interrupted, however, during the hot, dry summer, when no fruits are present and most groves afford little shelter for the adults. Dew is important in the coastal regions in maintaining suitable conditions of humidity, and in other regions, the flies survive in irrigated groves and those surrounded by hedges. Even in these, however, large populations cannot develop early in the autumn, as few early varieties of olives are cultivated and the fruits of those grown for oil are too small to be attacked until the end of September. Care should be taken before irrigated groves of table varieties are established, since these would not only be heavily attacked but would form a permanent source of infestation for later varieties. An investigation should be made of the relation of different olive varieties to parasitism by *O. concolor*, as it is possible that the ovipositing females are not able to reach larvae in fruits with thick pulp [cf. 25 536].

HUSSON (R.). *Ennomos quercinaria* Hfn., géométride nuisible aux hêtraies. —*Rev. Path. vég.* 33 fasc. 1 pp. 46–48, 6 refs. Paris, 1954.

In 1952–53, severe damage to beech [*Fagus*] and hornbeam [*Carpinus*] by larvae of *Ennomos quercinaria* (Hfn.) was reported from forests near Saarbrücken, where a similar outbreak had occurred in 1917 [*R.A.E.*, A 9 93], though this Geometrid has not been recorded as a pest of importance elsewhere. In 1952, infestation was limited to an area of about 175 acres and the defoliated trees developed new foliage, but in 1953, other foci were discovered and some of the defoliated trees remained bare. Observations on the bionomics of *E. quercinaria* showed that the overwintered eggs

hatched in April and early May, when the leaves appeared on the trees. The larvae were polyphagous, attacking many other trees, and pupated on the leaves in the second half of June. The first adults appeared at the end of June, maximum emergence occurring in July, and the eggs were laid on the trunks and branches and even on the upper twigs. Almost all the adults were of the typical variety in 1952, but about 20 per cent. belonged to var. *equestraria* (F.) in 1953; pairing between the two was observed.

NEPVEU (P.). **Observations sur la morphologie et la biologie des sésamies du maïs et du sorgho en France** (*Sesamia nonagrioides* Lef. et *S. cretica* Led.).—*Ann. Épiphyt.* **4** (1953) no. 4 pp. 445–457, 12 figs., 20 refs. Paris, 1954.

*Pyrausta nubilalis* (Hb.) and *Sesamia nonagrioides* (Lef.) [*cf. R.A.E.*, A **41** 68] were formerly the only Lepidopterous maize borers of importance in France [*cf. 20* 109], but *S. cretica* (Led.), which infests maize, sorghum and other cereals, was introduced into the Rhône Valley during the late war. It has since caused considerable damage to sorghum there, had spread to the valley of the Durance, near Briançon, by 1951, and as hybrid maize is now being grown extensively in the south of this region, in Camargue and in Crau, is thought likely to spread to that crop. The two species of *Sesamia* are morphologically very similar, and characters of the male antennae and the genitalia of both sexes differentiating them are described and illustrated. A list is given of other Lepidoptera that attack maize in south-eastern France, and the distribution of *S. cretica* and *S. nonagrioides* is reviewed [*cf. 41* 68]; the latter is widely distributed on maize throughout southern France, and full-fed larvae were taken on rice in the Camargue [*cf. 42* 133].

Observations showed that the bionomics of the two are similar, each having two generations a year. Larvae of *S. nonagrioides* fed mainly in the lower parts of the maize stalks and overwintered at the base [*cf. 12* 95]. The first-generation larvae of *S. cretica* on sorghum also attacked the stalks low down on the immature plants in June–July, but those of the second generation mostly fed and overwintered in the upper part of the main or secondary stalks and under the leaf sheaths on the upper part of the plant. Many of the larvae remained in the high stubble after harvest, but most were removed with the sorghum straw. When only the second generation caused severe damage, larvae were found usually above the sixth internode of the main stalk or at a corresponding height on secondary ones, but in fields in which the first generation was also injurious, damage was found along the whole stalk, and the second-generation larvae overwintered less frequently in the upper part, remaining in the galleries of the first generation at the base. *S. cretica* was better able to withstand lack of moisture than *S. nonagrioides*, and whereas in spring the latter was found in maize stubble at soil level or a little below, the former was found at all levels in sorghum and survived when transferred to dry split stems of sorghum or maize under conditions that were fatal to *S. nonagrioides*. However, both species are killed by excess of moisture if the stubble is ploughed under in autumn or spring. In tests in which overwintering larvae of *S. cretica* were kept at low temperatures, even exposure to  $-8^{\circ}\text{C}$ . [ $17.6^{\circ}\text{F}$ .] for three days had little effect on the number of adults that emerged [*but cf. 23* 521], and this species seems to be less susceptible to cold than is *S. nonagrioides*.

RAUCOURT (M.), VIEL (G.) & CHANCOGNE (M.). **Étude des actions ovicides.**

**IV. Toxicité des huiles et de diverses substances employées au laboratoire dans des conditions différentes.**—*Ann. Epiphyt.* **4** (1953) no. 4 pp. 459–466, 5 refs. Paris, 1954.

CHANCOGNE (M.), GRISON (P.) & VIEL (G.). **V. Détermination au verger de l'action ovicide des produits pour traitement d'hiver des arbres fruitiers.**—*T.c.* pp. 467–477, 1 graph, 14 refs.

In the first of these two parts of a series [*cf.* *R.A.E.*, A **42** 202], the results are given of further laboratory tests on the effectiveness of various products as winter ovicides, carried out with eggs of *Ephestia kuehniella* Zell. and *Operophtera brumata* (L.) by the techniques already noticed. All the products were first tested on eggs of *Ephestia* by immersion. The best results were obtained with parathion, which gave mortality percentages of 41, 54, 87 and 100 at concentrations of 0.00025, 0.0005, 0.001 and 0.005 per cent., respectively. Of several proprietary tar distillates (anthracene oils) tested, the best results were given by one of 40 per cent. strength, which killed 21, 50, 97, 48, 91 and 100 per cent. of the eggs at concentrations of 0.002, 0.004, 0.01, 0.05, 0.1 and 0.2 per cent. tar distillate, respectively, and one of 60 per cent. strength, which gave complete mortality at a concentration of 0.06 per cent. tar distillate. The mortality percentages for shale oil (schist oil) were 43, 64, 80 and 100 for oil concentrations of 0.03, 0.06, 0.12 and 0.24 per cent., respectively, from a product containing 60 per cent. oil, and 40, 71 and 100 for 0.03, 0.06 and 0.12 per cent. from one containing 70 per cent. oil. The corresponding percentages for two petroleum products each containing 83 per cent. oil were 0, 57 and 79 for oil concentrations of 0.08, 0.4 and 0.8 per cent. in one case and 76, 66, 90 and 95 for 0.8, 1.6, 2 and 4 per cent. in the other. A groundnut-oil preparation containing 60 per cent. oil killed 42, 56, 74, 95 and 100 per cent. of the eggs at concentrations of 0.125, 0.25, 0.5, 1 and 2 per cent. oil, respectively, and three lime-sulphur products containing 24–28 per cent. sulphur were not effective when applied at 2–8 per cent.

In further tests, the mortality of *Ephestia* eggs was compared with that of *Operophtera* by immersion and spraying. When a tar-distillate product of 72 per cent. strength was used, immersion resulted in 54, 77, 90 and 97 per cent. mortality of *Operophtera* eggs at concentrations of 0.003, 0.007, 0.014 and 0.035 per cent. tar distillate, respectively, and in 8, 50 and 92 per cent. mortality of *Ephestia* eggs at the last three concentrations; by the spray method, the mortality percentages were 11, 34, 42, 89 and 87 for *Operophtera* at concentrations of 0.07, 0.14, 0.35, 0.7 and 1.4 per cent. tar distillate, the corresponding percentages for *Ephestia* being 7, 20, 64, 96 and 97. When a product containing 83 per cent. petroleum oil was tested in the same ways, immersion resulted in 97, 98 and 100 per cent. mortality of *Operophtera* at concentrations of 0.06, 0.08 and 0.16 per cent. oil, respectively, and in 0, 57 and 79 per cent. mortality of *Ephestia* at concentrations of 0.08, 0.4 and 0.8 per cent. oil, respectively. By the spray method, 3, 11 and 39 per cent. of the eggs of *Operophtera* were killed by 0.4, 0.8 and 2.4 per cent. oil and 30 and 24 per cent. of those of *Ephestia* were killed by 0.8 and 1.6 per cent. The differences between the results given by the two methods of testing were thus greater for tar distillate and petroleum oil than for DNC [*cf.* **42** 203].

In the second part, a technique is described for testing winter ovicides under conditions approximating to those in the field. Apple twigs on which females of *O. brumata* have laid known numbers of eggs are attached to the extremities of the branches of a tree, the whole of which is then sprayed with the material to be tested, and the twigs are removed on the following

day and kept outdoors in moist sand until hatching is imminent, either sheltered from the rain or left unprotected. Mortality is calculated by counting the eggs that fail to hatch and either the empty egg-shells or the resulting larvae. Some eggs were lost in the course of the winter, but the proportion was not much affected by the treatments or exposure to the weather.

Sprays were applied on 7th January and 29th February in 1952 and 19th January and 3rd March in 1953, the twigs remaining outdoors until 8th and 15th March, respectively. DNC in oil gave good results, the mortality percentages for the first and (in brackets) the second application being 84-89 (99) for 3 per cent. of a product containing 2.5 per cent. DNC and 75 per cent. oil, and 56-69 (99) for 3 per cent. of one containing 3 per cent. DNC and 67 per cent. oil, and the increase in effectiveness for the later application was significant in the case of the second material. The corresponding percentages for 2 per cent. of a product containing 30 per cent. DNC as the sodium salt were 87 (96), and its effectiveness did not appear to be impaired by its high alkalinity (pH 9.7) [*cf.* 42 203]. A product containing 45 per cent. DNC as the ammonium salt, applied at 0.4 per cent., gave poor results, as also did products containing 70 per cent. tar distillate applied at 7 per cent. A product containing 45 per cent. tar distillate and 15 per cent. dinitrophenol applied at 3 per cent. on the first date in 1953 gave 64 per cent. mortality, and a concentrate containing 83 per cent. petroleum oil used at 4 per cent. gave 92-98 per cent. mortality when applied on the second date in each year but only 41 on the first. Mortality of untreated eggs was 2-9 per cent.

The method is also applicable to other insects, and in 1952, twigs bearing egg cases of *Hyponomeuta* were sprayed on the same dates as were the *Operophtera* eggs, the egg cases being lifted and the mortality of the larvae recorded at the end of March, about 15 days before emergence was due. Complete or almost complete mortality of the larvae was given by the spray of DNC (ammonium) and also by the sprays of DNC and oil, but tar distillate was considerably less effective and the petroleum-oil spray was very inferior. The mortality percentage for no treatment was 4-37. The date of treatment had little effect on mortality, and exposure to rain did not affect the products that gave the best results.

OZER (M.). **Contribution à l'étude biologique de la teigne des farines. Comportement de ponte et comportement alimentaire des chenilles.** —*Ann. Epiphyt.* 4 (1953) no. 4 pp. 479-509, 5 figs., 41 refs. Paris, 1954.

After reviewing from the literature the products attacked by *Ephestia kuehniella* Zell. and briefly discussing its distribution and probable country of origin, the author describes the reproductive organs of the males and females, summarises the observations of other workers on the length of life of the adults, the duration of pairing, the number of eggs laid and the length of the egg stage, and records investigations in the laboratory on these and on larval development. The results showed that adults that had paired died sooner than those that had not. The length of life was normally about 1-2 weeks, but exceeded a month in some circumstances. Pairing lasted for an average of 5-6 hours. Fertilised females laid 14-420 eggs each, whereas of the unfertilised females, 10 per cent. did not oviposit, 50 per cent. laid not more than 50 eggs each, and one individual laid 380. Most of the eggs were laid in the first few days of oviposition. In view of divergence in the literature as to the number of eggs laid, the effect of various factors on oviposition was studied.

When 117 fertilised females were kept at 28–32°C. [82·4–89·6°F.] in glass tubes covered for half their length with opaque black paper, 1,218 eggs were laid in the darkened sections and only 297 in the others. Examples given a choice of two substrates for oviposition preferred maize or wheat flour to grains of maize, confirming the importance of texture as a stimulus [*cf.* *R.A.E.*, A 37 54]. Females reared from maize preferred maize flour and those from wheat preferred wheat flour. The influence of temperature on oviposition was investigated by means of a horizontal glass tube cooled at one end and heated at various points towards the other to give a series of temperatures ranging from 12 to 40°C. [53·6–104°F.]. Pairs of adults were introduced into the tube, and the eggs laid in the various sections were counted after 24–48 hours. When 18 females and 17 males reared on maize at 17–20°C. [62·6–68°F.] were introduced, the numbers of eggs obtained were 30 at 12–15°C. [59°F.], 228 at 16–19°C. [60·8–66·2°F.], 935 at 20–23°C. [73·4°F.], 496 at 24–26°C. [75·2–78·8°F.], 95 at 27–29°C. [80·6–84·2°F.] and 9 at 30–32°C. [86–89·6°F.]. The corresponding numbers obtained from 45 females and 38 males reared at 28°C. [82·4°F.] were 34, 130, 457, 1,733, 3,693 and 366. No eggs were laid at 33–40°C. [91·4–104°F.]. The temperature at which the females were reared thus had some effect on the temperature preferred for oviposition. The eggs, which are briefly described, did not hatch at temperatures above 32°C., and the egg stage lasted at least 30 days below 12°C.

The number of larval instars [*cf.* 19 209; 21 58] was 4–10 for examples reared at 28°C. in wheat or maize flour, and tables are given showing the duration of each instar and the size of the mandibles. The complete larval stage lasted 29–132 days and was slightly though not significantly shorter in maize flour than in wheat flour. When larvae were given a choice of wheat or maize flour, those from a stock reared on wheat generally chose wheat and those from a stock reared on maize all chose maize. Further experiments were made to determine whether distinct races could be developed with a preference for maize or wheat for oviposition. The results showed that though a preference for one or the other could be increased by breeding for several generations from examples that chose either maize or wheat, subsequent removal during one generation to the other food material reversed the preference. An affinity for maize or wheat thus depended on the food of the larvae of the previous generation.

DUSSEL (J.). **Essais du parathion dans la lutte contre le carpocapse des pommés et des poires.**—*Rev. Zool. agric.* 53 no. 1–3 pp. 37–42, 2 graphs. 2 refs. Talence, 1954.

In the tests described, sprays of 0·225 and 0·3 lb. parathion per 100 gals. from an emulsion concentrate and a wettable powder, respectively, were compared with 0·725 lb. arsenic per 100 gals. in the form of lead arsenate against *Cydia pomonella* (L.) on apple and pear near Bordeaux. Treatments were applied on 20th–21st May, 9th–10th June, 6th–8th and 27th–29th July and 17th–18th August, and the infestation percentages on apple were 36·7, 31·6 and 40·9 for the three sprays, respectively, as compared with 66·1 for no treatment, on the fallen fruits, and 6·5, 5 and 20·4, respectively, as compared with 49·2, on the picked fruits at harvest. On pear, the corresponding percentages were 32·4, 39·8 and 38·3, as compared with 58·7, for the fallen fruits, and 1·6, 3·8 and 2·6, as compared with 9·1, for the picked ones. The yield was considerably increased by parathion, the best results being given by the wettable powder on apple and by the emulsion on pear.

SCHVESTER (D.). **Le xylébore disparate. Biologie et moyens de lutte.**—*Phytoma* 7 no. 62 pp. 9–12, 3 figs. Paris, 1954.

*Xyleborus (Anisandrus) dispar* (F.) is present in orchards in eastern, southern and south-western France, and though it is normally considered to attack mainly unhealthy or weakened trees, the author observed that 80 per cent. of the apple trees infested and about 50 per cent. of the pears and apricots were otherwise completely healthy. Apple was preferred to pear, and apricot was the most severely infested stone-fruit tree. In some orchards, 10–30 per cent. of the trees were attacked, and many, particularly the smaller trees, were killed by the Scolytid. The galleries and the life-history of the beetle are described.

The overwintered adults were found to emerge from the galleries when the maximum daily temperature reached about 20–22°C. [68–71·6°F.], usually between mid-March and mid-April. The males appeared first and disappeared after pairing, while the females sought suitable sites for their galleries. The first eggs were laid 10–15 days after the female entered the tree and before it had completed the gallery. The larvae hatched in a few days and became full-fed in 4–6 weeks, feeding on the mycelium of the fungus that serves them for food. The pupal stage lasted 10–15 days, and the adults remained in the galleries throughout the summer and winter, probably in diapause. There was only one generation a year.

The beetle can be controlled by treatments directed against the females seeking to enter the trees in spring, and they are still of use for 2–3 days after the beginning of the attack [*cf. R.A.E., A* 43 26], as the females frequently return to the entrance of the gallery. Applications can be timed by observations of the temperature in individual orchards. Sprays of 0·2 per cent. DDT or BHC with the addition of a wetter, or in the case of DDT, white oil, are recommended, and treatment should be repeated if emergence is interrupted. Reference is made to work in an apple orchard near Tarbes (Hautes-Pyrénées). In 1950, the first year of infestation, 50 of the 800 trees were attacked and 30 that died were removed. In 1951, 170 trees were attacked, and 138 of these were removed. After two sprays of 0·2 per cent. DDT in 1952, only 13 trees were attacked, of which three died, but in 1953, when no treatment was applied, 105 trees were attacked and 73 of them were dead or dying by the end of May.

BERVILLE (P.) & SCHAEFER (L.). **Un nouveau ver de la grappe.**—*Phytoma* 7 no. 62 pp. 18–19, 2 figs. Paris, 1954.

An adult that emerged from a pupa collected on grape vines in the southern Rhône Valley in 1953 and further adults taken on vines in the Department of Hérault in August 1954 were identified as *Eulia pulchellana* (Haw.) (*politana* (Haw.)), a polyphagous species not previously recorded from vines. It is believed to have been present on this food-plant for several years but to have escaped notice as its habits and the damage caused resemble those of *Clysiina ambigua* (Hb.). Investigations showed that vineyards over a considerable part of the Department were affected, and damage was severe in 1954 from 20th August. The larvae fed on the grapes and sometimes entered them, and also gnawed the pedicels, pupating in silken cocoons in contact with the grapes or occasionally in the fold of a leaf. Adults were observed near Montpellier from mid-August until late September. In cages, the pupal stage lasted about 11 days and adults emerged from 5th to 20th September. Since adults had been observed as early as June in 1953, *E. pulchellana* is thought to have two generations a year on vine, as on its other food-plants. The larva, pupa and adults are described.

DOMENICHINI (G.). *Degeeria luctuosa* (junebris) Meig. (Dipt. Larvex.) e *Perilitus deceptor* Wesm. (Hym. Bracon.) parassiti di *Melasoma aenea* L. adulta. [*D. luctuosa* and *P. deceptor*, Parasites of the Adults of *M. aeneum*.]—*Boll. Zool. agr. Bachic.* 19 fasc. 3 pp. 139–176, 1 pl., 7 figs., 19 refs. Milan, 1953.

The author describes all stages of the Tachinid, *Degeeria luctuosa* (Mg.), and all except the egg of the Braconid, *Perilitus deceptor* Wesm., two important endoparasites of the adults of *Melasoma aeneum* (L.) on alder (*Alnus*) in the Valtellina, near Lake Como. Observations on their bionomics in 1952–53 showed that the adults of *Degeeria* emerged in late May and June. Oviposition began 12–15 days after emergence, the eggs being laid, usually singly, between the elytra and the abdomen of *M. aeneum* and becoming attached to one of the former, usually at the outer edge of the tip. Occasionally up to four eggs were found on one beetle. The larvae hatched in three or more days in August and entered their hosts, in which they fed for 16–18 days. Vital tissues were not attacked until the larvae reached the third instar, but the females were prevented from ovipositing. The full-fed larvae left their moribund hosts and pupated under dry leaves or stones or even beneath the elytra of the host, and the pupal stage lasted 12–14 days. Two generations were completed between May and August, and second-instar larvae of the third overwintered within their hosts, which left the trees from mid-August to overwinter among dead leaves. The *Degeeria* larvae resumed feeding when their hosts returned to the trees in spring, and gave rise to adults that oviposited in the overwintered adults of *Melasoma*, some possibly surviving long enough to attack those of the first generation also.

The first adults of *P. deceptor* emerged on 15th May from overwintered *Melasoma* adults taken at the end of April, and emergence continued throughout June. The females were very active for the first few days after emergence. Pairing occurred after 1–2 days, and oviposition, which is difficult to observe, a few days later. The egg and larval stages together lasted 18 days in July, up to four larvae being found in one individual, though only one in each host completed its development. When full-fed the larvae abandoned their hosts and pupated some distance away. The hosts, if not already dead, died shortly afterwards. The pupal stage lasted 12 days in July. Dissection of adults of *Melasoma* in April showed that they contained second- and third-instar larvae of *Perilitus*, which is therefore presumed to overwinter in those stages. It is theoretically possible for four generations of the parasite to develop in a year. In the spring of 1953, 19·54 per cent. of the overwintered adults of *Melasoma* were parasitised by *Perilitus*, considerably more than in the previous year.

GRANDORI (R.). **La cianamide insetticida sistemico.** [Cyanamide, a systemic Insecticide.]—*Boll. Zool. agr. Bachic.* 19 fasc. 3 pp. 177–182, 4 refs. Milan, 1953.

Cyanamide, which is the only toxic product of the reaction of calcium cyanamide with water, has been shown to be absorbed by the roots of potato plants, rendering the leaves toxic to *Leptinotarsa decemlineata* (Say) [*R.A.E.*, A 42 241], and to be translocated in the plant without chemical change. In view of these findings, further tests of its systemic effect were made.

No mortality was observed in 24 hours when ten larvae of *Melasoma aeneum* (L.) were placed on leaves of alder (*Alnus*) taken from twigs that had stood in a 0·03 per cent. solution of pure cyanamide for 26 hours, but when

the larvae were transferred to leaves from twigs that had stood in a 0.06 per cent. solution for 30 hours, four died on the same day, two on the following day, and the remainder on the ninth and tenth days. In a further test, ten almost full-fed larvae were placed on leaves from twigs that had stood in a 0.06 per cent. solution for 16 hours; two died in 24 hours, one was moribund and two had pupated by the second day, and all the larvae and pupae were dead by the sixth day. Development in the controls was normal. When seven larvae of *Croesus (Nematus) septentrionalis* (L.) were placed on leaves from alder twigs that had stood in the 0.06 per cent. solution for 30 hours, they ceased to feed after 24 hours and when removed to untreated leaves, they died in 3-6 days. Of 20 third- and fourth-instar larvae of *Galerucella luteola* (Müll.) placed on elm twigs standing in a 0.05 per cent. solution of cyanamide, seven died in 24 hours and all in 48 hours, and when 20 first- and second-instar larvae were tested, 11 and 9 died in 24 and 48 hours, respectively. Larvae of *Lithocolletis rajella* (L.) (*alniella* Zell.) mining alder twigs all died in 33 hours when the twigs were stood in 0.06 per cent. cyanamide.

When pots containing young bean plants (*Vicia faba*) infested with 100 apterae of *Aphis fabae* Scop. were allowed to stand in solutions, no effects were observed until the fourth day, but mortality reached 47 per cent. in five days, 78 per cent. in five days and 100 per cent. in six days for 0.02, 0.03 and 0.04 per cent. cyanamide, respectively, as compared with 4 per cent. in three days for a pot standing in water only. In tests against larvae of *L. decemlineata*, various treatments were applied to a heavily infested potato field on 30th June or 1st July, after a period of drought. There was no mortality three days after dusting with calcium cyanamide at 900 lb. per acre and subsequent watering, but there was considerable scorching of the leaves [cf. 43 202]. When a solution of 3.25 per cent. calcium cyanamide was acidified with concentrated sulphuric acid to pH 7.2 and applied immediately to the plants without wetting the foliage, 27.2 per cent. of the larvae died in three days, and when it was applied 12 hours after being acidified, the percentage rose to 86. There was no mortality in an untreated plot.

Russo (G.). **Reperti biologici, sistemi e metodi di lotta sui principali insetti dannosi all'olivo.** [Notes on the Bionomics of the principal Pests of Olive and on Systems and Methods of controlling them.]—*Boll. Lab. Ent. agr. Portici* 13 pp. 64-95, 20 figs., 12 refs. Portici, 1954.

The main pests of olive in Italy are *Liothrips oleae* (Costa), *Saissetia (Coccus) oleae* (Bern.), *Pollinia pollini* (Costa), *Prays oleellus* (F.), *Phloeotribus scarabaeoides* (Bern.), *Rhynchites ruber* Fairm. and *Dacus oleae* (Gmel.). Notes varying in comprehensiveness are given on their distribution, the damage caused, methods of control and, in some cases, natural enemies, and *D. oleae* is dealt with in greater detail than the rest. Views as to the origin of the *Dacus* adults that infest olives in June and July are reviewed [cf. R.A.E., A 43 135, etc.]. During investigations on *Ceratitis capitata* (Wied.) on *Citrus* in the coastal areas and lowlands near Salerno, *Dacus* adults were taken in bait-pans in plantings near olive groves, and it is considered that adults that emerge in early spring can survive on the honeydew excreted by Aphids and Coccids on *Citrus* and other plants until olives become available for oviposition in June and July. The known parasites of *D. oleae* in Italy are *Dinarmus dacicida* Masi, *Eulophus longulus* (Zett.), *Eupelmus urozonus* Dalm., *Eurytoma nigrita* Boh. (which has been misidentified as *E. rosae* Nees), and *Ópius concolor* Szépl.; the literature on them is briefly reviewed.

SCOGNAMIGLIO (A.). **Contributo alla conoscenza della *Caliroa limacina* Retzius (Hymenoptera, Symphyta, Tenthredinoidea).** [A Contribution to Knowledge of *C. limacina*.]—*Boll. Lab. Ent. agr. Portici* **13** pp. 96–144, 21 figs., 32 refs. Portici, 1954. (With a Summary in English.)

Detailed descriptions are given of all stages of *Caliroa limacina* (Retz.), together with information on its distribution and food-plants and a brief review of the literature on its bionomics. During observations on its life-history in the field and the laboratory near Naples in 1950–53, the first adults of the overwintering generation emerged on 25th April in 1951, 17th May in 1952 and 12th May in 1953. The eggs were inserted into the lower surfaces of the leaves of cherry, quince and pear, a maximum of 28 per leaf being observed on cherry and 80 on pear. The egg stage lasted 8–12 days and averaged about ten. The larvae fed on the upper surfaces of the leaves and occasionally on the lower ones. Most of the damage was due to those of the first generation, which caused considerable leaf drop and a reduction in the yield of fruit. The larvae normally became full-fed in about three weeks, after which they entered the soil and formed cocoons at depths of 2–6 ins. Some individuals overwintered in the prepupal stage and pupated in the following spring, while others pupated at once and gave rise to adults in June–July. Second-generation larvae were less numerous than those of the first generation; they overwintered in the prepupal stage in the soil and pupated in the following spring.

The literature on the occurrence of parthenogenesis in *C. limacina* is reviewed [*cf. R.A.E.*, A **6** 130; **23** 493]. Males formed 43, 57 and 49 per cent. of the adults reared by the author in 1951, 1952 and 1953, respectively, and pairing was observed.

RUSSO (G.) & SANTORO (R.). **Esperimenti di lotta antidacica eseguiti in Ascea Marina (Salerno) nel 1953.** [Experiments on the Control of *Dacus oleae* in Ascea Marina (Salerno) in 1953.]—*Boll. Lab. Ent. agr. Portici* **13** pp. 207–283, 21 figs., 1 fldg. table. Portici, 1954; also in *Ann. Sper. agr. (N.S.)* **9** no. 2 pp. 349–381. Rome, 1955. (With Summaries in English.)

An account is given of further experiments on the control of *Dacus oleae* (Gmel.) on olive near Salerno [*cf. R.A.E.*, A **42** 359, etc.] carried out in 1953. Adults from overwintering pupae were observed in small numbers in March and April, but were very rare in May and June. Owing to unfavourable weather, the olives developed about a fortnight later than usual. Infestation was slight in July and early August, but became very heavy in the second half of October, after the beginning of the autumn rains, and almost the entire crop was destroyed on untreated trees.

The Berlese bait-spray of molasses and sodium arsenite [*cf. 41* 393] was applied 11 times between 20th June and 11th November, the intervals between treatments being reduced in the later months as infestation increased. The percentages of undamaged fruits on treated and (in brackets) untreated trees were 80.1–93.3 (63.2) on 6th October, 11.8–46.6 (0.71) on 26th October, 8.23–25.2 (1.37) on 10th November, and 0–37.1 (0) on 20th November, demonstrating the ineffectiveness of the method when populations are high [*cf. 42* 360]. No protection was given by 3 per cent. diammonium phosphate in trap-jars of various types or in bait-pans, and a mixture of molasses, unfermented wine, honey and an arsenical proved even less attractive. A repellent spray of 1 lb. clay in 1 gal. water, with an adhesive, applied seven times between 18th July and 13th October, gave good protection until the autumn rains, but all the fruits were infested by picking time, in November.

In tests with sprays prepared from a 50 per cent. DDT paste, good protection was also given only up to the time of the rains, and the percentages of injured fruits were high by November whether the paste was applied at 2 per cent. on 17th July, 3rd and 25th September and 14th October, at 2.5 per cent. on 17th July only or on 17th July and 3rd September, or at 2 and 3 per cent. twice on 20th June and again twice on 17th July. It is concluded that summer treatments alone are not adequate, as the DDT does not retain its effectiveness until the time of heavy infestation and the coating of inert matter that remains affords no protection. Applications of 2 per cent. of the paste on 26th September and 15th October gave good results until the insecticide was washed off by the rains in November, the percentages of uninjured fruits on treated and (in brackets) untreated trees being 83.1 (60.5) and 64.7 (0.71) on 6th and 26th October, respectively, and 33.2 (0.3), 22.2 (1.37) and 33.2 (0) on 5th, 10th and 20th November.

Dieldrin was applied at 0.8 and 1 per cent. in emulsion sprays on 16th July, 2nd and 24th September and 13th and 29th October, and at 1 per cent. on the first four dates. The percentages of fruits uninjured after these treatments, respectively, and (in brackets) on untreated trees were 26.6, 17.8 and 12.09 (1.17) on 10th November and 18.2, 18.6 and 14.6 (0) on 20th November. When 2 per cent. molasses was added to the weaker spray applied on all five dates, the percentages of uninjured fruits on treated and (in brackets) untreated trees were 99.5 (93.06) and 30.1 (3.83) on 6th and 26th October, respectively, and 9.22 (1.17) and 4.8 (0) on 10th and 20th November. A suspension spray of 2 per cent. of a paste containing 10 per cent. malathion and 50 per cent. DDT gave poor results when applied on 18th June, 3rd and 26th September and 13th October, as did this spray on the first date followed by one of 0.2 per cent. of an emulsion product containing 50 per cent. malathion on the other three.

Parathion (which unless otherwise stated was used at 0.1 per cent.) was applied in an emulsion spray on 25th September and 14th and 30th November, the last application being followed by heavy rain. The percentages of uninjured fruits (which in the parathion tests included fruits containing dead eggs or first-instar larvae) and (in brackets) the percentages on untreated trees were 87.9 (60.5) and 85 (0.71) on 6th and 26th October, respectively, and 95.5 (1.37) and 97.6 (0) on 10th and 20th November. Large numbers of eggs and young larvae in the fruits were destroyed by these treatments, which were not affected by rain, owing to the rapid penetration of the parathion into the olives. When an additional application was made on 6th November, the percentages were 73.9 (60.5) and 84.6 (0.71) on 6th and 26th October, and 97.6 (1.37) and 92.6 (0) on 10th and 20th November. An emulsion spray prepared from a different parathion concentrate (E 605 forte) was applied on 3rd and 13th October and 6th November, and the percentages of uninjured fruits on treated and (in brackets) untreated trees were 99.07 (60.5) and 53.7 (0.71) on 6th and 26th October, and 85.2 (1.37) and 99.06 (0) on 10th and 20th November. When a wettable-powder spray was applied on 26th September and 15th and 30th October, the corresponding percentages were 96.5 (63.2), 74.9 (0.71), 86.9 (1.37) and 97.6 (0), and when 0.6 per cent. of a wettable powder containing 15 per cent. parathion was applied on 2nd, 16th and 31st October they were 96.58 (63.2), 74.2 (0.71), 89.1 (1.37) and 98.35 (0). The corresponding percentages for a 4 per cent. parathion dust applied on 2nd, 14th and 30th October were 97.83 (60.5), 54.45 (0.71), 98.23 (1.37) and 95.73 (0) on the four sampling dates, respectively. Trees that received an additional dust application on 6th November showed 98.4 per cent. of the fruits uninjured on 20th November.

In tests with systemic insecticides, all used at 0.1 per cent. active ingredient, dimefox [bis(dimethylamino)fluorophosphine oxide] applied as a foliage spray on 3rd and 16th October and 6th November, or to the soil directly beneath the trees on 3rd and 16th October, proved ineffective, but Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate], applied to half of each of the experimental trees on 3rd and 16th October and 6th November, gave excellent results, the percentages of uninjured fruits (including those containing dead eggs or first-instar larvae) on treated and (in brackets) untreated halves being 99.4 (87.15) on 6th October, 54.15 (22.36) on 26th October, 82.1 (1) on 10th November, and 98.8 (0.47) on 20th November. Another systemic insecticide of unspecified composition gave similar results. Both products were about as effective as parathion, but there was little evidence of systemic action.

When the Berlese bait-spray was applied on 20th June, 14th July, 11th August and 2nd and 15th September and 0.1 per cent. parathion on 2nd, 15th and 31st October, or four applications of the former were followed by four of the latter on about the same dates, the percentages of uninjured fruits for the two programmes, respectively, and (in brackets) those on untreated trees were 83.1 and 79 (0.71) on 26th October, 82.01 and 86.4 (1.37) on 10th November, and 88.3 and 76.47 (0) on 20th November. The corresponding percentages for a spray of 2 per cent. of a paste product containing 45 per cent. DDT and 5 per cent. parathion applied on 16th July followed by three of 0.1 per cent. parathion on 25th September and 14th and 29th October were 84.6 (0.71), 83.39 (1.37) and 99.03 (0), and those for five applications of the paste on 16th July, 25th September, 14th and 29th October and 6th November were 84.6 (0.71), 97.5 (1.37) and 94.98 (0). When seven applications of the repellent spray of clay and adhesive, between 18th July and 13th October, were followed by two of 0.1 per cent. parathion on 31st October and 6th November, the percentages were 98.54 (1.37) on 10th November and 99.28 (0) on 20th November.

PELLEGRINI (G.). **Esperimenti di lotta antidacica svolti nel 1952 con un insetticida a base di p.nitrofenildietiltiofosfato.** [Experiments on the Control of *Dacus oleae* carried out in 1952 with an Insecticide containing Parathion.]—90 pp., 15 pls. (1 fldg.), 4 figs., graphs (2 fldg.). Montecatini, Cent. Sper. agr., 1954. (With Summaries in French, English and German.)

A detailed account is given of experiments carried out near Grosseto, on the coast of Tuscany, in 1952 on the control of *Dacus oleae* (Gmel.) on olive by means of sprays containing 0.0432, 0.0864 and 0.1728 per cent. parathion prepared from an emulsion concentrate. Fallen fruits were collected and examined at regular intervals, and the numbers infested were included in the total of fruits attacked.

In the first test, sprays were applied on 27th August (when infestation reached 0.85 per cent.), 20th September and 23rd October, and the crop was picked on 9th–15th December. The concentrations were varied on the different dates, but in no case did the average percentage of fruits injured exceed 0.6, as compared with 14.27–57.57 for no treatment. The percentages of oil in the olives, by weight, were about 9, 13.5 and 24 on the three spraying dates, respectively, and the residues of parathion in the pulp one day after each application were about 7.5–16, 2.5–7 and 7.5–9 parts per million, respectively, but fell to 3–4 p.p.m. in all groups by 12th December. The residues in the oil were 11–18.5 p.p.m.

In the second test, sprays varying in concentration according to schedule were applied on 15th September (when infestation reached about 30 per

cent.), 8th October and 5th November, and the crop was picked on 27th–29th January. The average percentages of fruits injured were 1.13–2.87, as compared with 41.82 for no treatment. In a variation of this, some trees were treated on the first two dates only, and the average percentages of fruits injured on the trees at picking were 0.2–1.79, as compared with 0.01–0.09 for three applications. The percentages of oil in the olives were about 8, 12.5 and 17.5 on the three spraying dates, respectively, and the parathion residues in the pulp on the day following each treatment were about 7.5–12, 3–8 and 4–9 p.p.m., respectively, falling to about 1.5–4 p.p.m. by 27th January, and the residues in the oil were 4–18.9 p.p.m. The residues on that date in olives treated only twice were less than 3 p.p.m., and those in the oil 2.1–15.2 p.p.m.

In the third test, the spray of 0.0864 per cent. parathion was applied on 19th August (when infestation was 3.48 per cent.), 16th September (repeated on 24th September because of rain during the previous application) and 3rd November, and the crop was picked on 14th January. The average percentages of fruits injured from treated and (in brackets) untreated trees of three varieties were 0.11 (94.5), 1.64 (80.29) and 1.32 (75.51), respectively. Analysis in late October showed that a minimum residue of 2 p.p.m. parathion in the pulp ensured complete control. Parathion residues in the oil were 11.8 p.p.m. In the fourth test, the same spray was applied on 10th September (when the average infestation was 32.59 per cent. and second-generation adults were numerous), 4th October and 2nd November. The crop was picked on 10th January, and the percentages of fruits injured from treated and (in brackets) untreated trees of three varieties were 2.58 (83.49), 4.26 (67.56) and 0.98 (69.72), respectively; 7 p.p.m. parathion was found in the oil.

It is pointed out in a discussion of these results that infestation became heavy on untreated trees as the olives began to change colour, but that its beginning was delayed and its development inhibited when the untreated trees were close to treated ones. The percentage infestation on the untreated trees in the first two tests would have been higher had they been further separated from the treated trees. Examination of the fallen fruits showed that though their numbers increased beneath all trees as the time of picking was delayed, the percentage infested increased less for treated trees than for untreated ones. Parathion killed the eggs and larvae in all instars, but had no effect on the pupae and emerging adults, though adults that alighted on treated leaves or fruits were killed.

The effectiveness of parathion for use on isolated trees was shown in a test in which half of a tree of a variety maturing in mid-November was sprayed with 0.0864 per cent. parathion on 2nd November; the percentages of fruits injured were 3.34 and 35.49 on the treated and untreated halves, respectively.

ANTONGIOVANNI (E.). **Prove sull'efficacia di alcuni prodotti a base di parathion nella lotta invernale contro le cocciniglie delle piante da frutto.**

[Tests of the Effectiveness of Products containing Parathion for Winter Treatment against Coccids on Fruit Trees.]—23 pp., 13 refs. Montecatini, Soc. gen. Industr. min. chim. Milano, 1954. (With Summaries in French, English and German.)

Experiments begun in Tuscany in 1949 having shown that a winter spray of parathion controlled the overwintering eggs of Aphids on fruit trees, tests were carried out to ascertain whether a similar treatment would be effective against *Quadraspidiotus* (*Aspidiotus*) *perniciosus* (Comst.) and *Epidiaspis* (*Diaspis*) *leperii* (Sign.), the most common and injurious Coccids

in orchards in the area. An emulsion concentrate containing 10 per cent. parathion (Oleofos) gave good results in 1951-52, and more detailed experiments were made near Pistoia in 1953. In tests against *Q. perniciosus*, Oleofos and two suspension products at concentrations affording 0.05 and 0.07 per cent. parathion were applied to heavily infested apple trees on 7th-12th March without previous scraping of the trunks or branches, and the results were assessed on 25th May and 17th-18th June, near the beginning and end, respectively, of the period during which the crawlers appeared on the untreated trees. On the first date, twigs were examined from each tree, and whereas infestation and development were normal on the untreated trees, very few living females and newly fixed crawlers were found on the treated ones, and it was evident that survival on the latter was due to incomplete coverage by the spray. On the second date, examination of 100 fruits per tree showed that the number of crawlers that became established on them ranged from 0 to 34 for the six treatments, as compared with 32,000-36,000 for none, and it is concluded that a single application at the lower concentration gives adequate control. A summer spray of 0.02 per cent. parathion was applied on 18th May to the control trees, before the first-generation adults had appeared, and very few living individuals were found 20 days later.

In tests against *E. leperii*, heavily infested pear trees were sprayed with Oleofos and one of the other materials at the same concentrations, on 5th March, also without previous scraping. Overwintered females were examined on 11th June and 10th July. On the first date, for every 100 examined, 642 eggs and dead or living crawlers and 179 crawlers that had become fixed were found on the untreated trees, as compared with 0 and 0 for Oleofos and 39-58 and 0-1 for the other material, respectively. The corresponding figures on the second date were 9 and 391 for no treatment, 0 and 0 for Oleofos and 4-154 and 0-1 for the suspension. Closer examination of material taken to the laboratory on the first date showed that the percentage of overwintered females surviving was 86.9 for no treatment, 0.9-1.1 for Oleofos and 3.9-17.5 for the suspension, and the numbers of eggs, living crawlers and fixed crawlers per 100 females were 104, 40 and 404 for no treatment, 3-24, 0-0.3 and 0.3-1 for Oleofos and 25-61, 3 and 1-12 for the suspension. Similar examination on the second date showed that the percentage of females that had reproduced normally was 94.5 for no treatment, 0-0.1 for Oleofos and 0.1-2.5 for the suspension, and the numbers of normal eggs, living crawlers and fixed crawlers per 100 females were 1, 0 and 664, 0.4-2, 0-0.1 and 0.7-0.8, and 5-10, 1 and 3-22, respectively. Of 75 twigs examined in the laboratory from each group of trees on the second date, all from the untreated trees were infested, as compared with 2-4 for Oleofos and 9-35 for the suspension.

GEIER (P.). *Adoxophyes orana* F.R. (= *Capua reticulana* Hueb.), une nouvelle tordeuse observée dans les vergers romands en 1953.—*Rev. rom. Agric.* 9 no. 10 pp. 83-84, 3 figs. Lausanne, 1953.

*Adoxophyes orana* (Fisch. v. Roesl.), which has recently injured fruit trees in north-western Europe [cf. *R.A.E.*, A 41 159, 303] and has been present on wild shrubs in Switzerland for many years, was found on fruit trees there for the first time in 1953, in Valais and near Lake Geneva. The overwintered larvae fed on the leaves of apple and pear in spring, pupated in webbed larvae and gave rise to adults in late May and early June. The first-generation larvae attacked the shoots and fruits in July and gave rise to adults in August. Larvae of the second generation attacked both leaves and fruits in September, though they were less injurious than those of the first, and overwintered.

PELET (F.), MÜNSTER (J.) & BOVEY (R.). **Essai de contrôle du vol du puceron *Myzus persicae* Sulz. à l'aide de pièges jaunes.**—*Landw. Jb. Schweiz* **68** pt. 9 pp. 917–930, 5 figs., 7 refs. Berne, 1954. (With Summaries in German, Italian and English.)

In order to facilitate determination of the correct time to harvest seed potatoes so that an economic crop is obtained and infection with virus diseases kept to a minimum, observations on the course of infestation by *Myzus persicae* (Sulz.), the principal vector of the viruses, and on the spread of the diseases, were carried out on a susceptible variety in a locality at about 1,000 ft. in the Swiss Canton of Valais in 1953. In the area concerned, Aphids normally appear early on potatoes, the date of the first appearance being 2nd June in 1951 and 24th May in 1952, and populations reached 898 apterae and 194 alates per 100 leaves by 14th July 1951 and 2,000 apterae and 1,000 adult and immature alates by 28th June 1952. The technique employed, which involved the use of 27 yellow trap dishes [cf. *R.A.E.*, A **39** 359] filled with a weak nicotine solution and exposed in and around an isolated field, is described; some of the traps were used in pairs, one being situated at a fixed height of about 3 ft. above the ground and the height of the other being adjusted to the height of the foliage [cf. **43** 98].

Migrants of *M. persicae* were first taken in the dishes on 18th–20th May, a few days before the potatoes sprouted, and the first colonies were found on the plants on 6th June; immature alates were observed on 22nd June and the population reached its maximum on 30th June. The main flight began about 24th June and reached its peak on 1st–3rd July. The minimum and maximum daily temperatures between 22nd June and 6th July were at least 12°C. [53.6°F.] and 19.5°C. [67.1°F.], and the relative humidity was 75 per cent. or more for at least 19 hours each day during that period. Statistical analysis of the catches showed a trend for fewer Aphids to be taken in dishes at a fixed height than in the corresponding ones in which the height was varied, though the difference approached significance only near the edges of the field. Dishes placed outside the edges had the smallest catches, and those just inside the field had in general smaller catches than those in the middle. Catches were greatest in the centre of the field, towards the southern side and in the southern corner, which was partly explained by the prevalence of northerly winds. It is concluded from further analysis that 4–8 dishes are sufficient to give reliable information on the course of the flight, whereas 1–2 suffice to determine the dates of its beginning and of its peak.

Samples of 50 plants were taken on five occasions, and the tubers examined for infection with virus Y or leaf-roll. The percentages of plants infected, of tubers infected and of tubers infected on the infected plants were 2.04, 0.41 and 20, respectively, on 30th June, 6, 1.8 and 30 on 8th July (a week after the maximum flight), 32, 14.9 and 46.2 on 15th July, 66, 35.7 and 54 on 27th July, and 54, 35.9 and 72.9 on 7th August. It is concluded that virus spread to the tubers became significant a fortnight after the peak of the flight and increased throughout the period of observations, though infection of the plants did not increase after about a month.

WURGLER (W.), STAEBELIN (M.) & BOLAY (A.). **Recherches sur la phytotoxicité de l'hexachlorocyclohexane (HCH).**—*Landw. Jb. Schweiz* **68** pt. 9 pp. 975–986, 9 figs., 10 refs. Berne, 1954. (With Summaries in German, Italian and English.)

After briefly reviewing the literature on the effects of BHC on plant growth and referring to a case in Switzerland of irregular germination and

deformation of the seedlings of spring rye sown in soil treated with  $\gamma$  BHC at 2.25 lb. per acre, the authors describe laboratory and greenhouse tests on various plants in 1952-53. Seeds of wheat, barley, beet and beans (*Phaseolus vulgaris*) were coated with proprietary preparations of  $\gamma$  BHC, alone or in BHC, and observed for germination and growth, and seedlings of wheat, rye and cress (*Lepidium sativum*) were grown on damp impregnated filter paper. It is concluded from the results that the phytotoxicity of BHC is mainly due to the  $\gamma$  isomer, which retards the growth of stems and roots and produces a thickening in the latter just behind the growing point. In cereals, the coleoptiles are also thickened. These effects were produced in the laboratory by  $\gamma$  BHC at rates exceeding about 0.42 oz. per acre, and they were aggravated by temperatures above 20°C. [68°F.]. The symptoms are generally less severe under field conditions.

BRENY (R.) & DETROUX (L.). *Rhogogaster viridis* L.: une tenthrède nuisible au fraisier.—*Parasitica* 9 no. 3 pp. 89-95, 1 pl., 12 refs. Gembloux. 1953. (With Summaries in Flemish, English and German.)

Larvae of *Rhogogaster viridis* (L.), which does not appear so far to have been recorded from strawberry, at least in Belgium, were found attacking the leaves in a young planting near Gembloux in October 1951. The distribution, food-plants and bionomics of this sawfly, which is polyphagous and of which the adults have been recorded as predacious [cf. *R.A.E.*, A 20 713], are briefly reviewed from the literature. Observations on larvae taken to the laboratory or kept in pots outdoors showed that they entered the soil on 20th-25th October and constructed cocoons in the upper 2 ins., the adults emerging at the beginning of April. In laboratory tests in which batches of 20 fourth- and fifth-instar larvae were dusted under a bell-jar with commercial preparations of DDT, BHC, lindane [almost pure  $\gamma$  BHC], chlordane, toxaphene, aldrin, dieldrin, parathion and derris and transferred to untreated leaves, parathion gave 90 and 85 per cent. mortality in 72 hours at concentrations of 0.5 and 1.5 per cent., respectively, and the other materials were ineffective, with the exception of 5 per cent. aldrin, which gave 55 per cent. kill; mortality in the controls was 20 per cent.

VAN DEN BRUEL (W. E.) & COLIN (G.). Le problème du tarsonème du fraisier. I. Essais d'orientation sur des traitements curatifs effectués sur champ (1951).—*Parasitica* 9 no. 1 pp. 14-35, 3 refs. Gembloux. 1953.

VAN DEN BRUEL (W. E.) & DERARD (J.). II. Essais de traitements curatifs effectués sur champ (1952).—*T.c.* no. 3 pp. 75-88, 10 graphs, 1 ref. III. Confrontation des méthodes de lutte proposées (essais 1953 + 1954).—*Op. cit.* 10 no. 4 pp. 133-156, 10 figs., 10 refs. 1954. (With a Summary in English.)

It is stated in the first part of this paper that *Steneotarsonemus* (*Tarsonemus*) *pallidus* (Banks), which was first recorded in Belgium in 1946 [cf. *R.A.E.*, A 36 353], is now widespread on strawberry in that country and is particularly injurious in the Meuse valley. In view of good control of this mite obtained in field tests in Germany with emulsion sprays of parathion and BHC applied to the plants three times at intervals of 2-3 and 7 days, respectively, in spring, after picking or in late summer, experiments with similar treatments were begun in Belgium in 1951. Rain frequently interrupted the work in that year. In tests with parathion emulsion sprays, less than 50 per cent. reduction in number of mites was

given by 0.03 per cent. E 605 forte [50 per cent. parathion] applied 3-4 times at intervals of 2-12 days in August-September at 108-225 gals. per acre, or by 0.1 per cent. Thiomex (15 per cent. parathion) applied three times at intervals of 2-4 days in September at 180 gals. per acre to give about the same amount of parathion (0.27 lb. per acre). When 0.13-0.17 per cent. Thiomex was similarly applied at 180-270 gals. per acre to give 0.4-0.57 lb. parathion per acre, few or no mites were found 19-21 days after the last treatment, and all six plants in each group (except four of those treated at the lowest concentration) were free from infestation when examined in the following June, though some in each were infested by 7th August. The best results were given by the highest concentration, though one variety was scorched by treatment at the rate of 0.5 lb. parathion per acre. Dusts of 1-2 per cent. parathion gave poor results when applied three times in early October. Small-scale experiments with emulsified solutions of BHC from a proprietary preparation gave promising results, and the respective advantages of treatment with BHC and parathion are discussed. Plants treated with BHC were more vigorous than those treated with parathion, and these latter more vigorous than untreated plants. The residues of parathion found in the central leaflets were high 24 hours after treatment, but fell rapidly, and it appeared that applications would have to be made at least every three days if an effective deposit is to be maintained.

The experiments were continued on the same plots in 1952, when conditions were more favourable. Infestation by *S. pallidus* was slight until July, and treatments were begun in August. Thiomex was applied at 0.125 and 0.17 per cent. once or three times at intervals of 3-9 days, and a BHC emulsion concentrate was similarly applied at and above the maximum concentration recommended by the manufacturers, all at the rate of 225 gals. per acre. In no case did the single application prove satisfactory. Three applications of Thiomex at the lower concentration gave inadequate reductions in infestation, except in one case in which infestation was initially low. At the higher concentration, three applications gave considerable reductions in the numbers of mites present, but these never fell below 70 per six plants. Three applications of BHC at either concentration also reduced the numbers of mites, but the results were inferior to those obtained with parathion. The variations in the interval between the treatments appeared to have no effect on the results, and none of the treated plants was freed from infestation. In all cases subsequent increase was rapid.

In 1953, four commercial parathion emulsion concentrates were compared at rates giving about 0.57 lb. parathion per acre in a field test in August. All gave results similar to those obtained in the preceding year. Sprays containing hexaethyl tetraphosphate, tetraethyl pyrophosphate, a thiocyanate, malathion, aldrin, dieldrin, Dimite [1,1-bis(p-chlorophenyl) ethanol], EPN [ethyl p-nitrophenyl thionobenzenephosphate], or sulphur, all from proprietary preparations, were applied twice in August, and sprays of Pestox 3 [schradan] and Systox [diethyl 2-(ethylmercapto)ethyl thio-phosphate] once. All reduced the numbers of mites, but none gave satisfactory control, and a subsidiary test showed that treatments with parathion or lime-sulphur were no more effective in May or July than in autumn. Dipping infested plants for 30-60 seconds in 0.17 per cent. Thiomex or 0.15 per cent. of a product containing 14-15 per cent.  $\gamma$  BHC in July 1952, before planting out, also failed to give complete control, and almost all the plants were infested by August 1953.

In tests of other treatments, infested planting material was fumigated in September 1952 with methyl bromide at 20 oz. per 1,000 cu. ft. for six

hours or immersed in water at a temperature of 46°C. [114.8°F.] for seven minutes. All the plants were free from infestation in September 1953, whereas untreated ones were still infested. Plants fumigated with methyl bromide and treated with normal care were as vigorous as untreated ones, and there was no detrimental effect on development. A hot-water apparatus similar to that of L. N. Staniland [cf. 38 148] is described.

The authors refer briefly to studies on the effect of parathion on the control of the mite by predators [39 384; 42 99] and conclude that as the field treatments proved of no value, planting material should be treated with methyl bromide or hot water and new plantings isolated from old, infested ones.

PARR (W. J.), CROCKER (C.) & SPEYER (E. R.). **Transmission of Chrysanthemum Flower-distorting Virus by Aphids.**—39th Rep. exp. Res. Sta. Cheshunt 1953 pp. 33–36. Cheshunt, Herts., 1954.

An account is given of investigations in which *Rhopalosiphum* (*Coloradoa*) *rufomaculatum* (Wils.), *Macrosiphum* (*Macrosiphoniella*) *sanborni* Gill. and *Anuraphis padi* (L.) (*Brachycauda helichrysi* (Kalt.)) were tested for ability to transmit the chrysanthemum flower-distorting virus [cf. R.A.E., A 43 280]. The first two of these Aphids are not known to breed on plants other than chrysanthemum and are common pests in nurseries in Britain; the third is less restricted but is common on chrysanthemum. None of them transmitted the virus.

PARR (W. J.), CROCKER (C.) & SPEYER (E. R.). **A Sciariid Fly injurious to Seedlings.**—39th Rep. exp. Res. Sta. Cheshunt 1953 pp. 36–39. Cheshunt, Herts., 1954.

Larvae of *Sciara modesta* Staeg. caused much injury to seedlings of tomato and *Nicotiana* in a heated greenhouse at Cheshunt during the winter by feeding on the root hairs, so that growth was retarded, and by tunnelling into the stems, so that the plants collapsed. In laboratory tests in which single pairs were caged over soil or horse manure, the females deposited 15–30 eggs each whether kept in light or darkness, at a mean temperature of 59°F. or at a constant temperature of 72°F. The egg stage lasted 9–12 days at mean temperatures of 58–60°F. and 8–9 days at a mean of 61.5° for eggs exposed to daylight, and 9–10 days at a mean temperature of 61.5°, 6–7 days at a mean of 64° and 4.5 days at 72°F. for those in the dark, from which it is concluded that exposure to light had no effect and that the incubation period is likely to last about six days in a greenhouse heated during the winter. In moist soil, the larval stage lasted a minimum of about 27 days at a mean temperature of 58°F. and 34–50 days at a constant temperature of 72°, and the pupal stage lasted 6–9 and 3–4 days at the two temperatures, respectively. A few larvae completed their development, in shorter periods, when kept individually in horse manure in glass cells at 72°F., but all were males. It was observed that some of the larvae spun cocoons in which they remained inactive for up to 24 hours before pupating.

In boxes and pots in which numerous larvae present to a depth of half an inch were retarding the growth of seedlings, thorough watering with parathion at a concentration of 0.0001 or 0.0002 per cent. had no ill effect on the plants and arrested the activity of the larvae in the soil of the tomato boxes, at least temporarily. Examination of treated soil from *Nicotiana* pots revealed moribund and dead larvae, though no active ones, two and six days after watering, but a single male emerged from a pupa found

after two days in soil treated at the higher concentration. Untreated soil contained active larvae and pupae that gave rise to adults, and it is concluded that 0.0002 per cent. parathion in water kills the majority of the larvae without injuring the seedlings, but that more than one application is necessary to ensure complete control.

MONRO (H. A. U.) & KING (J. E.). **The Behaviour of Methyl Bromide in the Vacuum Fumigation of Jute Bags.**—*J. Sci. Fd Agric.* 5 no. 12 pp. 619–628, 4 figs., 11 refs. London, 1954.

The results are given of investigations in which hydraulically-pressed bales of jute bags were fumigated with methyl bromide at a dosage of 3.5 lb. per 1,000 cu. ft. space for 3–4 hours in sustained vacuum or for 1–2 hours at the initial low pressure and two at atmospheric pressure [*cf.* *R.A.E.* A 41 349; 42 145]. The bales occupied about half the space in the fumigation chamber, and larvae of *Calandra* (*Sitophilus*) *granaria* (L.) and *Tenebroides mauritanicus* (L.) in containers were inserted into them at various depths and exposed on the top of the bales and in the free space. After fumigation, three air washes [42 39] were carried out and the insects were taken to the laboratory for examination.

Chemical analysis of gas samples taken during sustained-vacuum fumigation showed that the concentration of methyl bromide in the free space gradually fell below that within the bale. There was a similar tendency while the vacuum was maintained in the tests with released vacuum, and when atmospheric pressure was restored, the concentration fell very markedly in the free space and slightly at a three-inch depth in the bales, whereas it increased considerably at the centre of the bale, owing either to desorption of fumigant from surfaces within the bales as a result of the introduction of large amounts of air or to the driving in of the fumigant by the incoming air [*cf.* 42 362].

In general, insect mortality varied with gas concentration. Mortality of *T. mauritanicus* after sustained-vacuum treatment for three hours was nowhere complete, but was higher towards the centre of the bale and low in the free space. When the vacuum was released after one hour, mortality was complete towards the centre, but not elsewhere. Prolonging the exposure to four hours failed to give complete mortality inside the bale with a sustained vacuum, but resulted in complete kill throughout the bale when the vacuum was released after two hours. Failure was experienced in both tests on the surface and in the free space. *C. granaria* was more susceptible than *T. mauritanicus*, but mortality again tended to be higher towards the centre of the bale.

Gas sampling during air washing showed that with highly sorptive materials, such as jute bags, the alternate evacuation and restoration of atmospheric pressure does not remove the gas from the centre of the bale effectively, the vapour being alternately removed and carried back, and that continuous air washing for at least three hours would be necessary to remove all but a small fraction of the gas from the bales. However, the process removes dangerous concentrations from the free space, so that the chamber can be unloaded, and the residual fumigant in the bale prolongs the toxic effect of the treatment. Observations on this post-fumigation effect on the insects within the bales showed that it may be important; in the three-hour test with released vacuum, complete mortality of either species was achieved only as the result of post-fumigation, and even this failed to give complete kill in the outermost bag in the three-hour test with sustained vacuum.

POPOV (G. B.). **Notes on the Behaviour of Swarms of the Desert Locust (*Schistocerca gregaria* Forskål) during Oviposition in Iran.**—*Trans. R. ent. Soc. Lond.* **105** pt. 4 pp. 65–77, 5 pls., 3 figs., 6 refs. London, 1954.

The following is almost entirely the author's summary. Swarms of *Schistocerca gregaria* (Forsk.) observed between December 1950 and June 1951 in southern Persia [cf. *R.A.E.*, A **43** 293] varied in the proportion of mature and immature individuals and in sex-ratio. Differential behaviour of mature and immature locusts explains this variation, the mature individuals tending to remain at a roosting site when the immature ones depart, and the sexes differing in rate of maturation and therefore in behaviour. Pairing began at an air temperature of 64°F. and coincided in time with the start of the vigorous flying activity of the immature locusts of the same swarms. It was sometimes accompanied by other forms of activity. Mass oviposition was recorded within an air-temperature range of 72–92°F., but the preliminary probing sometimes began at lower temperatures. The settling of a mixed swarm in an area in which the mature females in it subsequently oviposited seemed to be attributable, like that of immature migrant swarms, to such factors as fatigue and visual attraction of vegetation, and to be unrelated to the suitability of the area for egg-laying. After settling, the initial selection of egg-laying sites was made by the crawling locusts during pairing, and the final choice was made by the probing of females. The selection of sites was apparently governed by a preference for certain moisture, soil and temperature conditions. Females ready to oviposit assembled in groups characterised by isolation and compactness and by the high density of locusts within them. It is suggested that the position and size of the groups were related to the nature of the terrain, but there appeared to be no reason for the high density other than gregarious inter-attraction. The high degree of selectivity shown by locusts in their choice of oviposition sites may be important as a factor in the concentration of non-gregarious individuals.

#### PAPERS NOTICED BY TITLE ONLY.

BALDWIN (J. M.). ***Ceroplastes destructor* and *Ceroplastes rubens*. A Review of the Literature. References from the Review of Applied Entomology, Series A, January 1913 to December 1950.**—[3+] 28 pp., multigraph. Melbourne, Commonw. sci. industr. Res. Org. Aust., Agric. Res. Liaison Sect., 1953.

PENGELLY (R.). **Pesticide Quarterly Supplement no. 9, April 1955.**—pp. 432–454, 12 refs., multigraph. [Canberra] Dep. Hlth. Aust., 1955. [Cf. *R.A.E.*, A **41** 155, 448.]

BEER (R. E.). **A Revision of the Tarsonemidae of the Western Hemisphere (Order Acarina).**—*Kans. Univ. Sci. Bull.* **36** pt. 2 pp. 1091–1387, 25 pls., 8½ pp. refs. Lawrence, Kans., 1954.

HAWES (I. L.). **Index IX to the Literature of American Economic Entomology January 1, 1948 to December 31, 1949.**—*Spec. Publ. ent. Soc. Amer.* no. 9 [8+] 528 pp. Washington, D.C., 1954. **Index X . . . 1950.**—*Spec. Publ. Amer. Ass. econ. Ent.* no. 10 [7+] 322 pp. College Park, Md., 1952. **Index XI . . . 1951.**—*Op. cit.* no. 11 [8+] 325 pp. 1953. [Cf. *R.A.E.*, A **40** 320.]

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